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11
MASSACHUSETTS
ANNUAL
AIR QUALITY
REPORT
FOR
1976 and 1977 11



*Department of
Environmental Quality Engineering*

*Division of
Air and Hazardous Materials*

November, 1978

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Approved by Alfred C. Holland, State Purchasing Agent

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Section 1 - - Introduction

This Air Quality Report contains the air quality monitoring data for all Massachusetts Air Sampling Network sites operating in 1976 and 1977. A site directory is included as well as figures showing air quality trends. The data contained has been compared with the National Ambient Air Quality Standards (Section 3) to determine compliance. The Division of Air and Hazardous Materials (DAHM) utilizes these data in determining present and future regulatory actions, and to judge the success or failure of past actions.

The air quality data summaries can be obtained separately, as can the site directory, and the seven year trend charts. Please address inquiries to:

Data Analysis Section
Division of Air and Hazardous Materials
Room 320
600 Washington Street
Boston, MA 02111

Section 2 - - Summary

The air quality goals of the Massachusetts Department of Environmental Quality Engineering's Division of Air and Hazardous Materials are established by Federal and State law to protect the health of the citizens of Massachusetts from known or anticipated adverse effects of air pollution. The Department has made notable progress in reducing industrial related pollutant emissions, such as sulfur dioxide (SO₂) and total suspended particulates (TSP) in Massachusetts. However, serious problems remain with the transportation source related pollutants--carbon monoxide (CO) and ozone (O₃) i.e., smog.

Recorded violations of air quality standards in Massachusetts for the year 1976 show that 100 percent of the Department's ozone monitoring sites, 80 percent of the carbon monoxide monitoring sites and 22 percent of the TSP monitoring sites had violations at least once during the year. In 1977, 100 percent of the ozone monitoring sites, 89 percent of the carbon monoxide monitoring sites and 11 percent of the TSP monitoring sites recorded air quality violations. There were no violations recorded in this two year period at the Department's sulfur dioxide and nitrogen dioxide monitoring sites.

The ozone violations continue to be the most serious air quality problem. More than one-third of the summer days in Massachusetts continue to have ozone levels in excess of the health related federal air quality standard. In some cases the levels were approximately twice the standard. Unlike other pollutants that are concentrated in specific areas, (TSP + CO) ozone is a region-wide pollutant affecting everyone in the Commonwealth.

High ozone concentrations in Massachusetts are in large part due to the pollutants generated by transportation related sources, in particular, the automobile. Hydrocarbon emissions from industrial sources also contribute to ozone formation. The Division of Air and Hazardous Materials is presently pursuing several control strategies that will help reduce the ozone concentrations experienced in the Commonwealth. These strategies include:

- Obtaining legislative authority to initiate an annual automobile emissions inspection and maintenance program.
- Controlling industrial hydrocarbon emissions.
- Improving mass transit incentives.
- Continuing and expanding the use of commuter car and van pools.
- Interstate, Regional cooperation to control the transport of ozone and precursor emissions from states outside the Commonwealth.

Carbon monoxide violations experienced in the Commonwealth would also be reduced by the above mentioned control strategies since 99 percent of the carbon monoxide emissions are caused by automobile exhaust. Improved traffic flow patterns are needed in areas where the recorded carbon monoxide levels are highest since elevated levels are attributable to congested traffic situations.

The TSP violations fall into two categories, primary and secondary violations. The primary standard is designed to protect public health and the secondary standard is designed to protect visibility, property and vegetation. Of the twelve TSP violations in 1976, all exceeded the secondary standard while only three violated the primary standard. In 1977 three of the six recorded TSP violations exceeded the primary standard.

There has been some question concerning the representativeness of these TSP violations. The Division feels that the violations are primarily due to the influence of passing traffic kicking up road particles, dust, etc., in the vicinity of the TSP monitors. If this theory is correct, the recorded violations would not be truly representative of ambient air quality in these areas.

A number of industries and utilities in Massachusetts and the U.S. Department of Energy, along with the Division of Air & Hazardous Materials and the Massachusetts Science and Technology Foundation have combined resources in a large study to determine the exact cause of these TSP violations. If the results of this study show these monitoring sites to be representative of localized problems, the Division's past restrictions on open burning dumps, incinerators, industrial processes, etc. would prove to be sufficient to achieve the federal air quality standards and would preclude the need for more stringent particulate emission limitations.

The dramatic decrease in sulfur dioxide air quality levels between 1970 and 1974 as a result of strict sulfur-in-fuel regulations, combined with the higher cost of low-sulfur fuel, led the Massachusetts legislature to pass Chapter 494 of the General Laws of 1974. This legislation required the Department to allow industries and utilities meeting specific stringent conditions to burn a higher-sulfur content (lower cost) fuel. The conditions that must be met include: protection of the air quality standards and public health, analysis of potential air quality impacts, the on-site storage of low sulfur fuel, (to be burned on days with poor meteorological conditions) and the establishment of a source oriented and operated air quality monitoring network. It is estimated that the Chapter 494 program has saved the Commonwealth \$30 million per year in fuel costs.

Since the enactment of Chapter 494, Division management, engineering and technical personnel have been primarily occupied with developing and implementing a sophisticated plan that permits the burning of less costly, higher-sulfur content fuel while continuing to protect the air quality standards for sulfur dioxide. This balancing of air quality and economic concerns in Massachusetts has put an extraordinary strain on the resources of the Division as the Division continues to respond to the Federal air quality attainment goals as well as the economic goals of Chapter 494.

Section 3 - - National and Massachusetts Ambient Air Quality Standards

Table 1 lists the National and Massachusetts Ambient Air Quality Standards currently in effect. The primary standards are designed to protect the public from both acute and chronic health effects, while the secondary standards are designed to minimize the economic impact of air pollution upon vegetation and property.

The ambient air quality standards were established by the Clean Air Act of 1970. Continuing medical and epidemiological research will undoubtedly add new pollutants to this list, and possibly alter existing standards.

TABLE 1

NATIONAL AND MASSACHUSETTS AMBIENT AIR QUALITY STANDARDS

CONTAMINANT	TYPE OF AVERAGE & AVERAGING TIME	PRIMARY STANDARD	SECONDARY STANDARD
SULFUR DIOXIDE (SO ₂)	ANNUAL ARITHMETIC MEAN	80 ug/m ³ (0.03 ppm)	SAME
	*MAXIMUM 24 HOUR AVERAGE	365 ug/m ³ (0.14 ppm)	SAME
	*MAXIMUM 3 HOUR AVERAGE	NONE	1300 ug/m ³ (0.5 ppm)
TOTAL SUSPENDED PARTICULATES (TSP)	ANNUAL GEOMETRIC MEAN	75 ug/m ³	**60 ug/m ³
	*MAXIMUM 24 HOUR AVERAGE	260 ug/m ³	150 ug/m ³
CARBON MONOXIDE (CO)	*MAXIMUM 8 HOUR AVERAGE	10 mg/m ³ (9ppm)	SAME
	*MAXIMUM 1 HOUR AVERAGE	40 mg/m ³ (35ppm)	SAME
PHOTOCHEMICAL OXIDANTS: Measured as OZONE (O ₃)	*MAXIMUM 1 HOUR AVERAGE	160 ug/m ³ (0.08 ppm)	SAME
NITROGEN DIOXIDE (NO ₂)	ANNUAL ARITHMETIC MEAN	100 ug/m ³ (0.05 ppm)	SAME

* Not to be exceeded more than once per year.

** This is a guide to be used in assessing implementation plans.

Section 4 - - Health and Welfare Effects

Table 2 contains a brief summary of the health and welfare effects of the criteria pollutants. A more detailed discussion of these effects can be obtained from numerous publications among which are the following:

- . "Health Effects of Exposure to Low Levels of Regulated Air Pollutants - A Critical Review", Benjamin G. Ferris, Jr., M.D., Harvard School of Public Health; Journal of the Air Pollution Control Association, Volume 28, No.5, May 1978.
- . "Health Effects of Air Pollution", American Thoracic Society, Medical Section of American Lung Association, 1978.
- . "Air Pollution, Volume II, The Effects of Air Pollution, Edited by Arthur C. Stern, Third Edition, Academic Press, 1977.

TABLE 2

HEALTH AND WELFARE EFFECTS

POLLUTANTS AND THEIR SOURCES	HEALTH EFFECTS	WELFARE EFFECTS
Ozone and other Photochemical Oxidants (Products of reactions of motor vehicle exhaust, industrial process emissions and other fossil fuel combustion emissions, in the presence of sunlight).	Causes difficulty in breathing, especially when exercising, irritates eyes, may result in an increased susceptibility to respiratory infection.	Toxic to plants by causing both leaf damage and a decrease in growth. Can weaken materials such as rubber and fabrics
Total Suspended Particulates (Fossil fuel burning, industrial process emissions, motor vehicle exhaust, traffic movement over dusty roads).	Causes further distress to those with chronic lung diseases, can alter the lungs natural cleansing mechanism and can either be composed of or have toxic materials adhered to the surface.	Causes soiling of materials, are corrosive and can damage buildings. In addition causes haze which reduces visibility and the amount of solar energy reaching the earth.
Carbon Monoxide (Internal combustion engines, fossil fuel combustion and cigarette smoking).	Reduces the blood's ability to carry oxygen which may cause heart and brain damage. Causes a decreased exercise capacity in those with angina pectoris. Also can cause slowed physical reactions, dizziness, fatigue and headache.	No known effect on materials or vegetation.
Sulfur Dioxide (Combustion of fossil fuel)	Irritation of throat and lungs and aggravation of symptoms among those with chronic lung diseases.	Corrosion and deterioration of metals, brittleness of paper, discoloration of paint and deterioration of fabric. Causes leaf damage to some plants.
Nitrogen Dioxide (Emitted from motor vehicles and fossil fuel burning operations such as power plants as well as from chemical plants and refineries).	Aggravation of symptoms in those with asthma and chronic bronchitis an increased susceptibility to respiratory infections and a decrease in lung function.	Fading of dyes, yellowing of leaves in plants, and changing the horizon to a reddish brown color.

Section 5 - - Massachusetts Air Surveillance Network (MASN)
for 1976 and 1977

The Massachusetts Air Sampling Network is composed of both continuous and non-continuous sampling instruments. The network has operationally been oriented to determine ambient air quality in the various Air Quality Control Regions. These Air Quality Control Regions were designed utilizing urban-industrial concentrations, jurisdictional boundaries, and atmospheric conditions to yield an area adequate for the assessment of air quality and the implementation of air quality control measures.

The "continuous" network consists of automated continuous analyzers at 16 trailers throughout Massachusetts which produce hourly data seven days a week. These analyzers are linked by telemetry equipment to a computerized data processing and storage facility located in the central office of Air & Hazardous Materials in Boston. The continuous network monitors for the following pollutants:

- Sulfur Dioxide (SO₂)
- Ozone (O₃)
- Carbon Monoxide (CO)
- Nitrogen Dioxide (NO₂)

Metorological parameters (wind speed and wind direction) on a continuous basis as well are monitored.

The "non-continuous" network is composed of gas impingement trains, commonly referred to as bubblers, and high volume filters. This network is operated on a modified (random) schedule of sampling one day every six days. The non-continuous network monitors for the following pollutants:

- Sulfur Dioxide (SO₂)
- Total Suspended Particulates (TSP)
- Nitrogen Dioxide (NO₂)

General descriptions of the sampling methodologies for both continuous and non-continuous sampling is found in Sections 6.0 and 7.0.

Table 3 lists the number of sites measuring each pollutant in 1976 and 1977 as well as the percentage in violation. Tables 4 and 5 identify those sites which had violations in 1976 or 1977. Table 6 lists the one day in six sampling schedule for the non-continuous network.

The Site Directory (Table 7) includes the following information for each site:

- Site Address
- Universal Transverse Mercator (UTM) Coordinates
- Elevation above ground of the intake ports
- Station type (the first term describes the physical environment of the site; Suburban, Center City, rural. The second term describes the predominant influence upon the sites; mobile, agriculture, residential, commercial, industrial, other.)
- Pollutants measured in each year
- Presence of telemetry equipment.

The Figures 1 through 5 are maps of the Air Quality Control Regions showing the locations of the non-continuous monitoring sites. Figures 6 through 9 are maps of the state showing the locations of the continuous monitoring sites.

TABLE 3

NUMBER OF SAMPLING SITES AND PERCENTAGE
IN VIOLATION OF NAAQS IN 1976 and 1977

POLLUTANT	1976			1977		
	NUMBER OF SITES	NUMBER WITH VIOLATION	% OF SITES IN VIOLATION	NUMBER OF SITES	NUMBER WITH VIOLATION	% OF SITES IN VIOLATION
SO ₂ Non-continuous	57	0	0	59	0	0
SO ₂ Continuous	15	0	0	16	0	0
NO ₂ Non-continuous	57	0	0	14	0	0
NO ₂ Continuous	2	0	0	5	0	0
TSP Non-continuous	55	12	22	56	6	11
CO Continuous	10	8	80	9	8	89
O ₃ Continuous	19	19	100	10	10	100

TABLE 4

1976 SAMPLING SITES IN VIOLATION OF AMBIENT AIR QUALITY STANDARDS

CITY	SITE IN VIOLATION	POLLUTANTS IN VIOLATION			
		CARBON MONOXIDE	OZONE	SUSPENDED PARTICULATES	
				Secondary	Primary
AMHERST	UNIVERSITY OF MASS.		X		
ASHLAND	4-H CENTER		X		
ATTLEBORO	LaSALLETTT SHRINE		X		
BOSTON	KENMORE SQUARE	X		X	
EAST BOSTON	CALLAHAN TUNNEL	X			
CAMBRIDGE	SCIENCE PARK	X			
CHICOPEE	WATER TREATMENT PLANT		X		
DANVERS	ESSEX AGRICULTURAL INST.		X		
FAIRHAVEN	TOWN WHARF		X		
FALL RIVER	GLOBE STREET TRAILER		X		
FITCHBURG	WATER STREET FIRE STA			X	
FITCHBURG	G & E SUBSTA, SUMMER ST		X		
FRAMINGHAM	CIVIL DEFENSE HDQRTRS		X		
GREENFIELD	WATER TREATMENT PLANT		X		
LAWRENCE	GENERAL HOSPITAL			X	
LOWELL	JOHN STREET MUNIC GARAGE		X		
MEDFIELD	STATE HOSPITAL		X		
MEDFORD	WELLINGTON CIRCLE	X	X	X	
PITTSFIELD	DALTON AVE, STATE POLICE		X	X	
QUINCY	FORE RIVER BRIDGE	X	X		
SALEM	HIGHLAND AVENUE		X		
SPRINGFIELD	TAYLOR STREET			X	
SPRINGFIELD	EAST COLUMBUS AVENUE	X		X	X
WALTHAM	UNIV OF MASS FIELD STA		X		
WALTHAM	MOODY AND MAIN STREETS	X			
WEST NEWBURY	REGIONAL JR HIGH SCHOOL		X		
WORCESTER	MARCUS DEPARTMENT STORE			X	X
WORCESTER	PARKER BUILDING			X	
WORCESTER	WASHINGTON & NEW SALEM STS	X	X	X	X
WORCESTER	HEALTH DEPARTMENT			X	
WORCESTER	QUINSIGAMOND COLLEGE			X	

TABLE 5

1977 SAMPLING SITES IN VIOLATION OF AMBIENT AIR QUALITY STANDARDS

CITY	SITE IN VIOLATION	POLLUTANTS IN VIOLATION			
		CARBON MONOXIDE	OZONE	SUSPENDED PARTICULATES	
				Secondary	Primary
AMHERST	UNIV. OF MASSACHUSETTS		X		
ATTLEBORO	LaSALLETTE SHRINE		X		
BOSTON	KENMORE SQUARE	X		X	X
EAST BOSTON	CALLAHAN TUNNEL	X			
CAMBRIDGE	SCIENCE PARK	X			
DANVERS	ESSEX AGRICULTURAL INST.		X		
FALL RIVER	GLOBE STREET TRAILER		X		
MEDFIELD	STATE HOSPITAL		X		
MEDFORD	WELLINGTON CIRCLE	X	X		
PITTSFIELD	DALTON AVE., STATE POLICE		X		
QUINCY	FORE RIVER BRIDGE	X	X		
SPRINGFIELD	EAST COLUMBUS AVE.	X		X	X
WALTHAM	MOODY AND MAIN STREETS	X		X	
WEST NEWBURY	REGIONAL JR. HIGH SCHOOL		X		
WORCESTER	MARCUS DEPARTMENT STORE			X	
WORCESTER	WASHINGTON AND NEW SALEM	X	X	X	X
WORCESTER	HEALTH DEPARTMENT			X	

TABLE 6

SAMPLING SCHEDULE FOR THE NON-CONTINUOUS NETWORK

MONTH	DAY IN 1976	DAY IN 1977	MONTH	DAY IN 1976	DAY IN 1977
JANUARY	01	01	JULY	05	06
	07	07		11	12
	13	13		17	18
	19	19		23	24
	25	25		29	30
	31	31	AUGUST	04	05
FEBRUARY	06	06		10	11
	12	12		16	17
	18	18		22	23
	24	24		28	29
MARCH	01	02	SEPTEMBER	03	04
	07	08		09	10
	13	14		15	16
	19	20		21	22
	25	26		27	28
	31		OCTOBER	03	04
APRIL	06	01		09	10
	12	07		15	16
	18	13		21	22
	24	19		27	28
	30	25	NOVEMBER	02	03
MAY	06	01		08	09
	12	07		14	15
	18	13		20	21
	24	19		26	27
	30	25	DECEMBER	02	03
		31		08	09
JUNE	05	06		14	15
	11	12		20	21
	17	18		26	27
	23	24			
	29	30			

TABLE 7

1976 - 1977 SITE DIRECTORY

CITY SITE LOCATION	SAROAD # DIST #	UTM COORD EAST NORTH	HGT ABOVE GROUND (f)	STATION TYPE	1976/1977 POLLUTANTS SAMPLED						
					NON- CONTINUOUS			CONTINUOUS			
					SO2	TSP	NO2	SO2	CO	O3	NO2

BERKSHIRE AIR QUALITY CONTROL REGION (117)											
ADAMS SEWAGE TREATMENT PLT	0020-001 BK-07	654.9 4722.8	20	SUBURBAN- RESIDENTIAL	X	X	X				
LEE SEWAGE TREATMENT PLT	1020-001 BK-06	644.0 4682.0	5	RURAL- OTHER	X	X	X				
NORTH ADAMS HOLDEN STREET	1580-002 BK-08	654.5 4729.2	8	CENTER CITY- INDUSTRIAL	X	X	X				
PITTSFIELD HIBBARD SCHOOL	1800-002 BK-04	645.7 4700.9	40	SUBURBAN- RESIDENTIAL	X	X	X				
PITTSFIELD DALTON AVE, STATE POL	1800-003 BK-03	646.9 4702.6	15	CENTER CITY- COMMERCIAL	X	X	X	X	X	X	X

CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)											
ATHOL CITY HALL, MAIN ST.	0100-001 CM-08	727.4 4719.2	60	CENTER CITY- COMMERCIAL	X	X	X				
FITCHBURG CITY HALL, 778 MAIN	0620-002 CM-12	269.7 4718.2	50	CENTER CITY- COMMERCIAL	X		X				
FITCHBURG G&E SUBSTA, SUMMER ST	0620-003 CM-13	271.5 4716.8	15	CENTER CITY- INDUSTRIAL	X		X	X	X		X
FITCHBURG WATER ST. FIRE STATN	0620-004 CM-14	270.9 4717.2	25	CENTER CITY- COMMERCIAL	X	X	X				
FITCHBURG G&E BLDG, 655 MAIN ST	0620-006 CM-16	269.9 4718.2	33	CENTER CITY- COMMERCIAL	X	X	X				
WARREN QUABOAG REG. HIGH RIVER STREET	2372-001 CM-10	731.9 4679.9	16	RURAL- AGRICULTURAL	X	X	X				
WORCESTER NARCUS DEPT STORE 810 MAIN STREET	2640-004 CM-02	269.9 4682.6	60	CENTER CITY- INDUSTRIAL	X	X	X				
WORCESTER CLARK UNIV, 950 MAIN	2640-008 CM-01	267.0 4681.2	60	CENTER CITY- INDUSTRIAL	X	X	X				
WORCESTER PARKER BLDG, 75 GROVE	2640-009 CM-07	268.9 4683.9	50	CENTER CITY- COMMERCIAL	X	X	X				
WORCESTER QUINSIGAMOND COLLEGE	2640-011 CM-05	269.6 4688.1	60	CENTER CITY- COMMERCIAL		X	X				
WORCESTER NEW SALEM & WASH STS	2640-012 CM-11	269.0 4682.1	15	CENTER CITY- COMMERCIAL	X	X	X	X	X	X	X
WORCESTER HEALTH DEPT, BELMONT	2640-013 CM-15	272.3 4683.7	15	CENTER CITY- RESIDENTIAL	X	X	X				

TABLE 7 (cont)

1976 - 1977 SITE DIRECTORY

CITY SITE LOCATION	SAROAD # DIST #	UTM COORD EAST NORTH	HGT ABOVE GROUND (f)	STATION TYPE	1976/1977 POLLUTANTS SAMPLED						
					NON- CONTINUOUS			CONTINUOUS			
					SO ₂	TSP	NO ₂	SO ₂	CO	O ₃	NO ₂

MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)											
AYER DIST CRT HSE, RTE 2A	0140-001 MV-06	288.8 4714.7	45	SUBURBAN- RESIDENTIAL	X	X	X				
HAVERHILL CITY HALL NORTH & ESSEX STS	0840-001 MV-02	330.0 4738.0	75	CENTER CITY COMMERCIAL	X	X	X				
LAWRENCE GEN. HOSP., 1 GARDEN	1000-003 MV-10	324.0 4730.5	70	CENTER CITY INDUSTRIAL	X	X	X	X			
LOWELL HIGH SCHOOL, KIRK ST	1080-001 MV-04	310.5 4723.8	60	CENTER CITY COMMERCIAL	X	X	X				
LOWELL FATHER NORTON MANOR 137 HIGH STREET	1080-003 MV-07	312.4 4723.1	30	CENTER CITY COMMERCIAL	X	X	X				
LOWELL MUNICIPAL GARAGE JOHN STREET	1080-004 MV-09	310.6 4723.9	25	CENTER CITY COMMERCIAL	X	X		X	X	X	X
NEWBURYPORT SULLIVAN BLDG 25 TEMPLE STREET	1520-002 MV-08	347.1 4721.0	80	CENTER CITY COMMERCIAL	X	X	X				
WEST NEWBURY PENTUCKET REG. H.S. MAIN STREET	2467-001 MV-11	335.8 4738.2	12	SUBURBAN RESIDENTIAL						X	X

METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)											
ASHLAND 4-H YOUTH CENTER 466 CHESTNUT ST	0092-001 MB-30	297.5 4680.0	15	RURAL AGRICULTURAL	X	X				X	X X
BOSTON J.F.K. BUILDING	0240-001 MB-02	330.4 4691.8	85	CENTER CITY COMMERCIAL	X	X	X				
BOSTON KENMORE SQ., 590 COMM	0240-002 MB-01	327.1 4690.4	10	CENTER CITY COMMERCIAL	X	X	X	X	X		X
BOSTON FIRE HEADQUARTERS 115 SOUTHAMPTON ST.	0240-012 MB-04	329.3 4608.5	40	CENTER CITY INDUSTRIAL	X	X	X				
BOSTON CALLAHAN TUNNEL VISCONTI STREET	0240-016 MB-25	332.0 4692.5	15	CENTER CITY MOBILE	X		X			X	X X X X

TABLE 7 (cont)

1976 - 1977 SITE DIRECTORY

CITY SITE LOCATION	SAROAD # DIST #	UTM COORD EAST NORTH	HGT ABOVE GROUND (f)	STATION TYPE	1976/1977 POLLUTANTS SAMPLED						
					NON- CONTINUOUS			CONTINUOUS			
					SO ₂	TSP	NO ₂	SO ₂	CO	O ₃	NO ₂

METROPOLITAN BOSTON AQCR (continued)											
BROCKTON PAINE SCHOOL CRESCENT STREET	0320-003 MB-SE	333.3 4660.4	30	CENTER CITY INDUSTRIAL	X	X					
BROOKLINE HIGH SCHOOL 115 GREENOUGH STREET	0340-001 MB-17	324.5 4688.8	70	SUBURBAN RESIDENTIAL	X	X	X				
CAMBRIDGE HARVARD HERBARIUM 22 DIVINITY AVE.	0360-001 MB-11	329.9 4693.3	60	SUBURBAN COMMERCIAL	X	X	X				
CAMBRIDGE MUSEUM OF SCIENCE	0360-004 MB-05	329.2 4692.6	15	CENTER CITY INDUSTRIAL	X	X	X	X	X		X X
CHELSEA FIRE HEADQUARTERS CHESTNUT & SIXTH STS	0380-002 MB-32	332.5 4695.1	42	CENTER CITY COMMERCIAL		X					
DANVERS ESSEX AGRICULTURAL INSTIT., RTE 62	0480-002 MB-29	337.8 4777.2	40	RURAL AGRICULTURAL					X	X	
FRAMINGHAM MIDDLESEX COURT HOUSE ROUTE 126	0660-001 MB-14	301.3 4685.0	50	SUBURBAN RESIDENTIAL	X	X	X				
FRAMINGHAM MASS CIVIL DEFENSE 400 WORCESTER RD	0660-002 MB-24	301.0 4685.5	10	SUBURBAN COMMERCIAL					X		X X
LYNN CITY HALL, MAIN ST.	1100-001 MB-06	339.6 4703.0	90	CENTER CITY COMMERCIAL	X	X	X				
MARBLEHEAD JUNIOR H.S.	1160-001 MB-07	346.6 4707.2	20	SUBURBAN RESIDENTIAL	X	X	X				
MAYNARD ARMY METEORLOGY	1200-001 MB-13	296.3 4698.7	10	RURAL OTHER	X	X	X				
MEDFIELD STATE HOSPITAL	1210-001 MB-28	307.2 4675.8	75	RURAL AGRICULTURAL				X	X		X X
MEDFORD FIRE HEADQUARTERS	1220-002 MB-08	326.3 4697.8	20	SUBURBAN COMMERCIAL	X	X	X				
MEDFORD WELLINGTON CIRCLE	1220-003 MB-19	328.6 4696.6	15	SUBURBAN MOBILE	X	X	X	X	X	X	X X
NEEDHAM GLOVER MEM'L HOSP	1480-003 MB-33	314.5 4658.8		CENTER CITY RESIDENTIAL	X	X	X				

TABLE 7 (cont)

1976 - 1977 SITE DIRECTORY

CITY SITE LOCATION	SAROAD # DIST #	UTM COORD	HGT ABOVE GROUND (f)	STATION TYPE	1976/1977 POLLUTANTS SAMPLED						
		NON- CONTINUOUS			CONTINUOUS						
		SO2 TSP NO2			SO2 CO O3 NO2 Wind Tele						

METROPOLITAN BOSTON AQCR (continued)

NORWOOD	1700-001	318.7	30	SUBURBAN	X	X	X					
NAHATAN ST, FIRE STA.	MB-18	4673.3		COMMERCIAL	X	X						
QUINCY	1880-002	337.3	16	SUBURBAN	X	X	X	X	X	X		X X
FORE RIVER BRIDGE	MB-21	4678.6		INDUSTRIAL	X	X	X	X	X	X		X X
ROUTE 3A												
QUINCY	1880-007	332.4	30	SUBURBAN	X	X	X					
ATLANTIC FIRE STATION	MB-31	4682.1		RESIDENTIAL	X	X						
HANCOCK STREET												
REVERE	1940-002	336.0	40	SUBURBAN	X	X	X					
GARFIELD JR. H.S.	MB-10	4698.1		RESIDENTIAL	X	X						
368 GARFIELD STREET												
SALEM	1980-001	342.9	15	SUBURBAN				X		X		X X
HIGHLAND AVENUE	MB-27	4707.8		RESIDENTIAL				X				X X
WALTHAM	2340-003	317.7	30	SUBURBAN	X	X	X			X		
UNIV OF MASS FIELD ST	MB-12	4694.6		AGRICULTURAL								
BEAVER STREET												
WALTHAM	2340-004	315.9	15	SUBURBAN	X	X	X	X	X			X X
MOODY & CARTER STS	MB-20	4693.5		COMMERCIAL	X	X	X	X	X			X X
WOBURN	2620-002	323.0	40	CENTER CITY	X	X	X					
MIDDLESEX CNTY COURT	MB-09	4705.0		COMMERCIAL	X	X						
WOBURN SQUARE												

PIONEER VALLEY AIR QUALITY CONTROL REGION (042)

AMHERST	0060-001	703.8	45	RURAL						X		
UNIV OF MASS	PV-10	4695.8		OTHER						X		
PUBLIC HEALTH CNTR												
CHICOPEE	0400-001	697.7	40	CENTER CITY	X	X	X					
CITY HALL	PV-03	4668.8		COMMERCIAL	X	X						
MARKET SQUARE												
CHICOPEE	0400-003	696.9	30	SUBURBAN	X	X	X					
MEADOW ST SCHOOL	PV-07	4670.9		COMMERCIAL	X	X						
CHICOPEE	0400-004	696.5	25	SUBURBAN						X		
WATER TREATMENT PLNT	PV-12	4669.0		RURAL								
80 MEDINA STREET												
CHICOPEE	0400-005	696.9	15	CENTER CITY	X		X	X				X
CHICOPEE STREET	PV-14	4673.7		INDUSTRIAL	X		X	X				X

TABLE 7 (cont)

1976 - 1977 SITE DIRECTORY

CITY SITE LOCATION	SAROAD # DIST #	UTM COORD EAST NORTH	HGT ABOVE GROUND (f)	STATION TYPE	1976/1977 POLLUTANTS SAMPLED						
					NON- CONTINUOUS			CONTINUOUS			
					SO ₂	TSP	NO ₂	SO ₂	CO	O ₃	NO ₂

PIONEER VALLEY AQCR (continued)											
GREENFIELD WATER TREATMENT PLNT DEERFIELD STREET	0780-002 PV-13	697.1 4673.7	25	RURAL OTHER	X	X	X			X	
HOLYOKE FIRE STATION 452 MAIN STREET	0860-002 PV-18	697.4 4674.3	40	CENTER CITY INDUSTRIAL	X	X					
HOLYOKE WATER POWER BLDG CANAL STREET	0860-004 PV-04	698.0 4675.2	30	CENTER CITY INDUSTRIAL	X	X	X				
HOLYOKE BEAUDRY BONCHER APTS 68 CABOT STREET	0860-006 PV-19	698.0 4665.2	30	CENTER CITY INDUSTRIAL	X	X					
NORTHFIELD NORTHFIELD SCHOOL EASTHALL PATH	1652-001 PV-08	709.3 4732.1	4	RURAL OTHER		X					
SPRINGFIELD FIRE STATION 25 MILL STREET	2160-002 PV-02	700.0 4662.4	45	CENTER CITY COMMERCIAL	X	X	X				
SPRINGFIELD FIRE STATION 142 TAYLOR STREET	2160-003 PV-01	699.2 4664.3	40	CENTER CITY COMMERCIAL	X	X	X				
SPRINGFIELD EAST COLUMBUS AVENUE	2160-005 PV-06	699.2 4663.4	15	CENTER CITY COMMERCIAL	X	X	X	X	X	X	X

SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)

ATTLEBORO CITY HALL ANNEX 25 S MAIN STREET	0120-002 SE-05	311.0 4644.0	40	CENTER CITY RESIDENTIAL	X X	X X	X					
ATTLEBORO LaSALLETTES SHRINE 947 PARK STREET	0120-003 SE-10	312.0 4644.3	15	CENTER CITY RESIDENTIAL				X X		X X		X X
FAIRHAVEN TOWN WHARF MIDDLE STREET	0570-001 SE-08	341.0 4611.0	10	SUBURBAN COMMERCIAL				X X		X		X X
FALL RIVER FIRE STATION 165 BEDFORD STREET	0580-001 SE-04	321.0 4619.0	50	CENTER CITY COMMERCIAL	X X	X X	X					

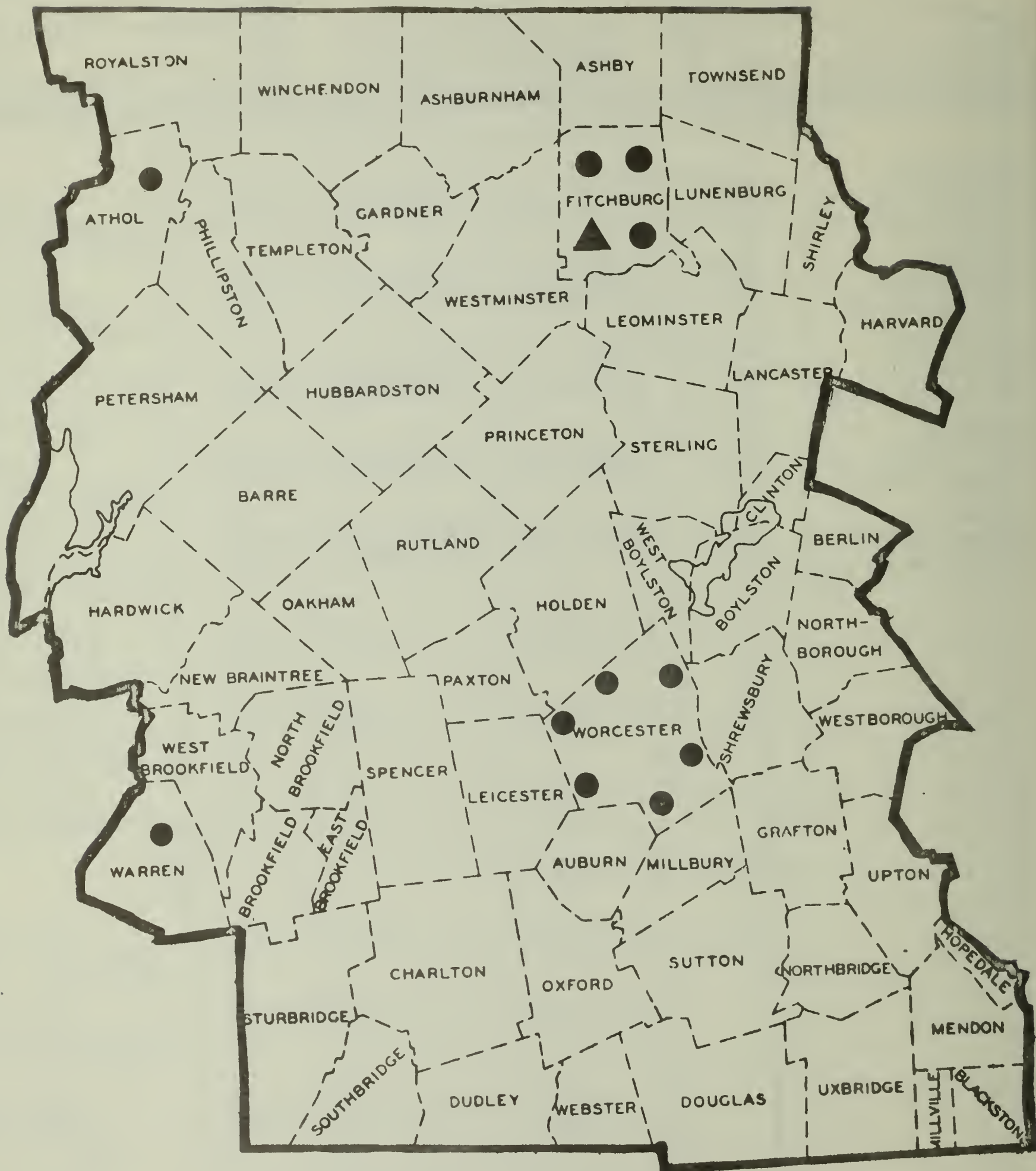
TABLE 7 (cont) 1976 - 1977 SITE DIRECTORY

CITY SITE LOCATION	SAROAD # DIST #	UTM COORD EAST NORTH	HGT ABOVE GROUND (f)	STATION TYPE	1976/1977 POLLUTANTS SAMPLED						
					NON- CONTINUOUS			CONTINUOUS			
					SO ₂	TSP	NO ₂	SO ₂	CO	O ₃	NO ₂

SOUTHEASTERN MASSACHUSETTS AQCR (continued)											
FALL RIVER FIRE STATION LOT GLOBE STREET	0580-004 SE-06	319.7 4616.9	15	CENTER CITY COMMERCIAL	X	X	X	X	X	X	X
FALMOUTH FIRE STATION 399 MAIN STREET	0600-001 SE-02	366.0 4601.0	40	CENTER CITY INDUSTRIAL	X	X	X				
NEW BEDFORD HIGH SCHOOL 455 COUNTY STREET	1500-002 SE-03	339.0 4611.0	60	CENTER CITY INDUSTRIAL	X	X	X				
PLYMOUTH FIRE STATION 51 MAIN STREET	1820-001 SE-01	362.0 4646.0	40	CENTER CITY COMMERCIAL	X	X	X				
TAUNTON MORTON HOSPITAL 88 WASHINGTON STREET	2240-001 SE-09	326.2 4641.2	60	CENTER CITY RESIDENTIAL	X	X	X				

FIGURE 1

CENTRAL MASSACHUSETTS AQCR (118)
NON-CONTINUOUS MONITORING NETWORK



● - OPERATING IN 1976 & 1977

▲ - OPERATING IN 1976 ONLY

FIGURE 2

MERRIMACK VALLEY-SOUTHERN NEW HAMPSHIRE AQCR (121)
NON-CONTINUOUS MONITORING NETWORK

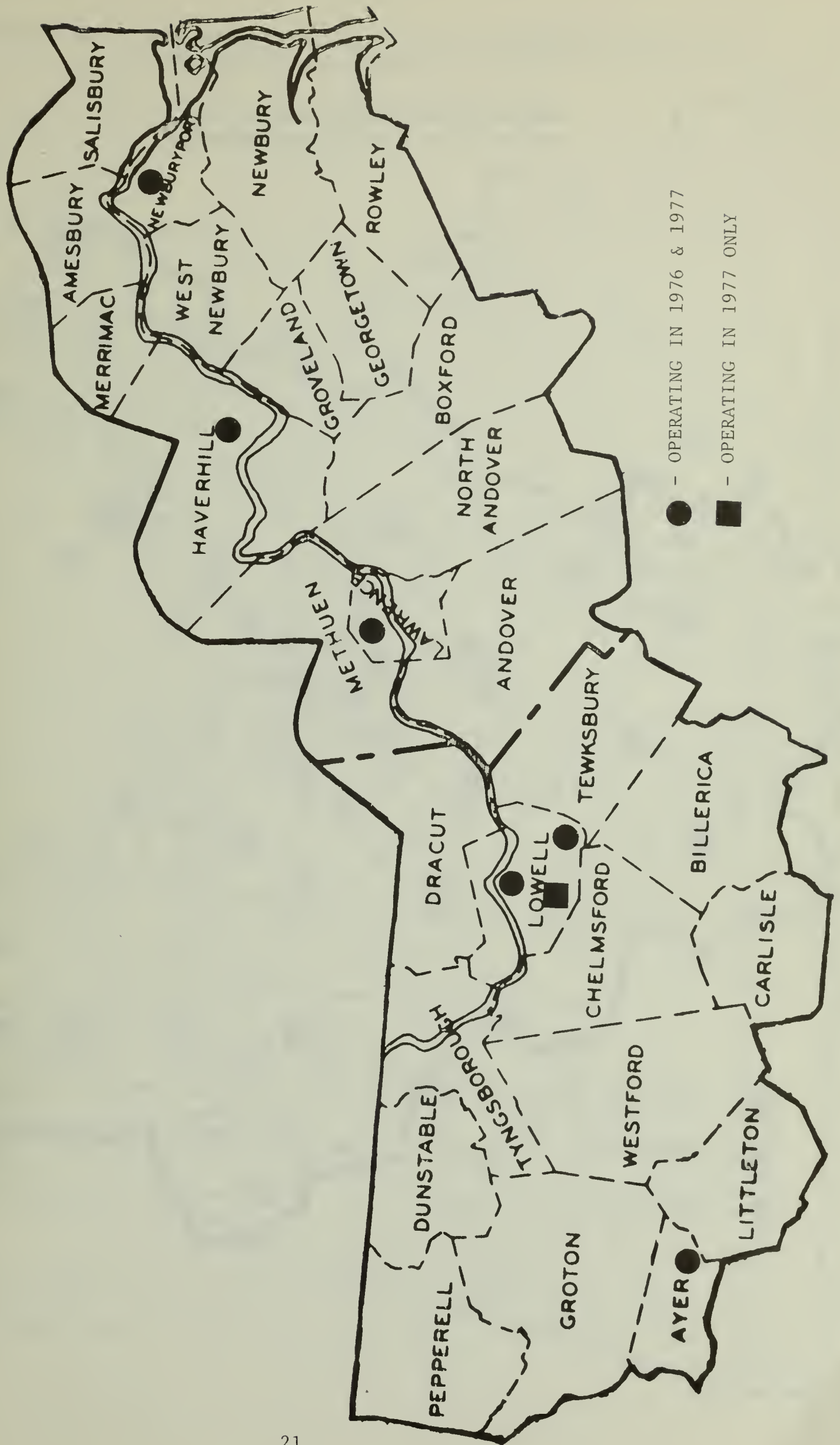


FIGURE 3

METROPOLITAN BOSTON AQCR (119)
NON-CONTINUOUS MONITORING NETWORK



HARTFORD-NEW HAVEN-SPRINGFIELD AQCR (042) AND BERKSHIRE AQCR (117)
NON-CONTINUOUS MONITORING NETWORK

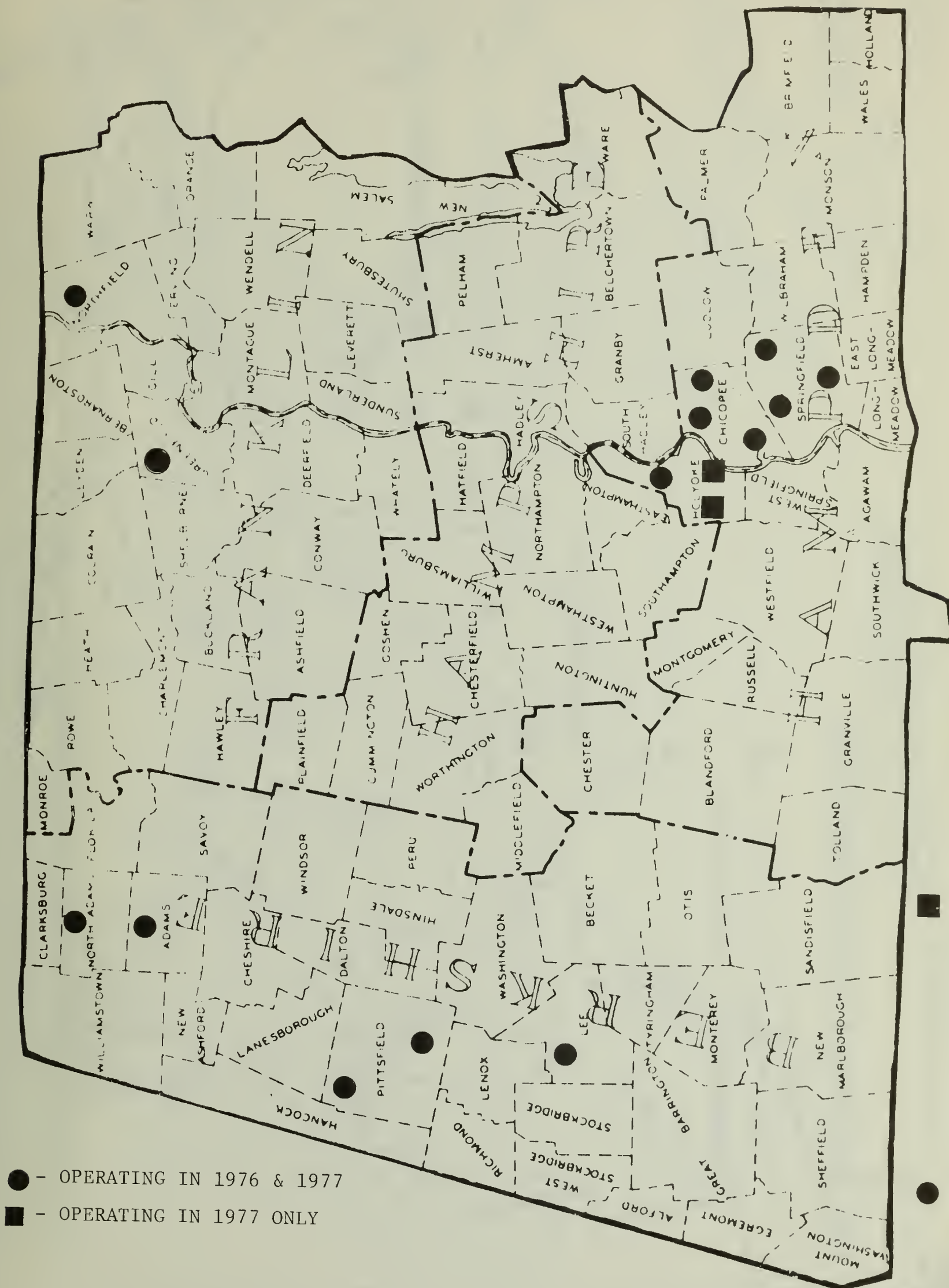


FIGURE 5

METROPOLITAN PROVIDENCE AQCR (120)
NON-CONTINUOUS MONITORING NETWORK

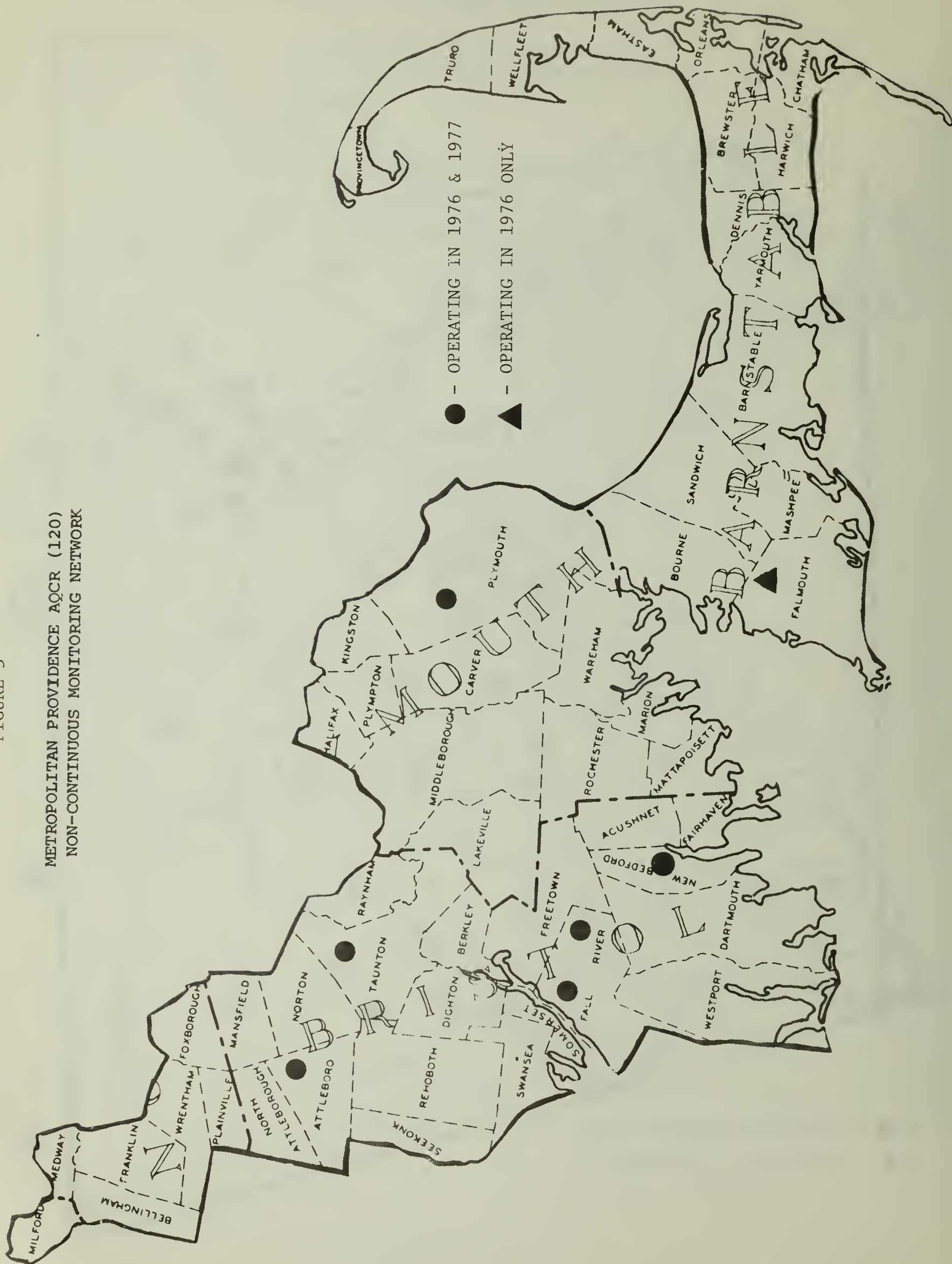


FIGURE 6
CONTINUOUS MONITORING NETWORK
CARBON MONOXIDE

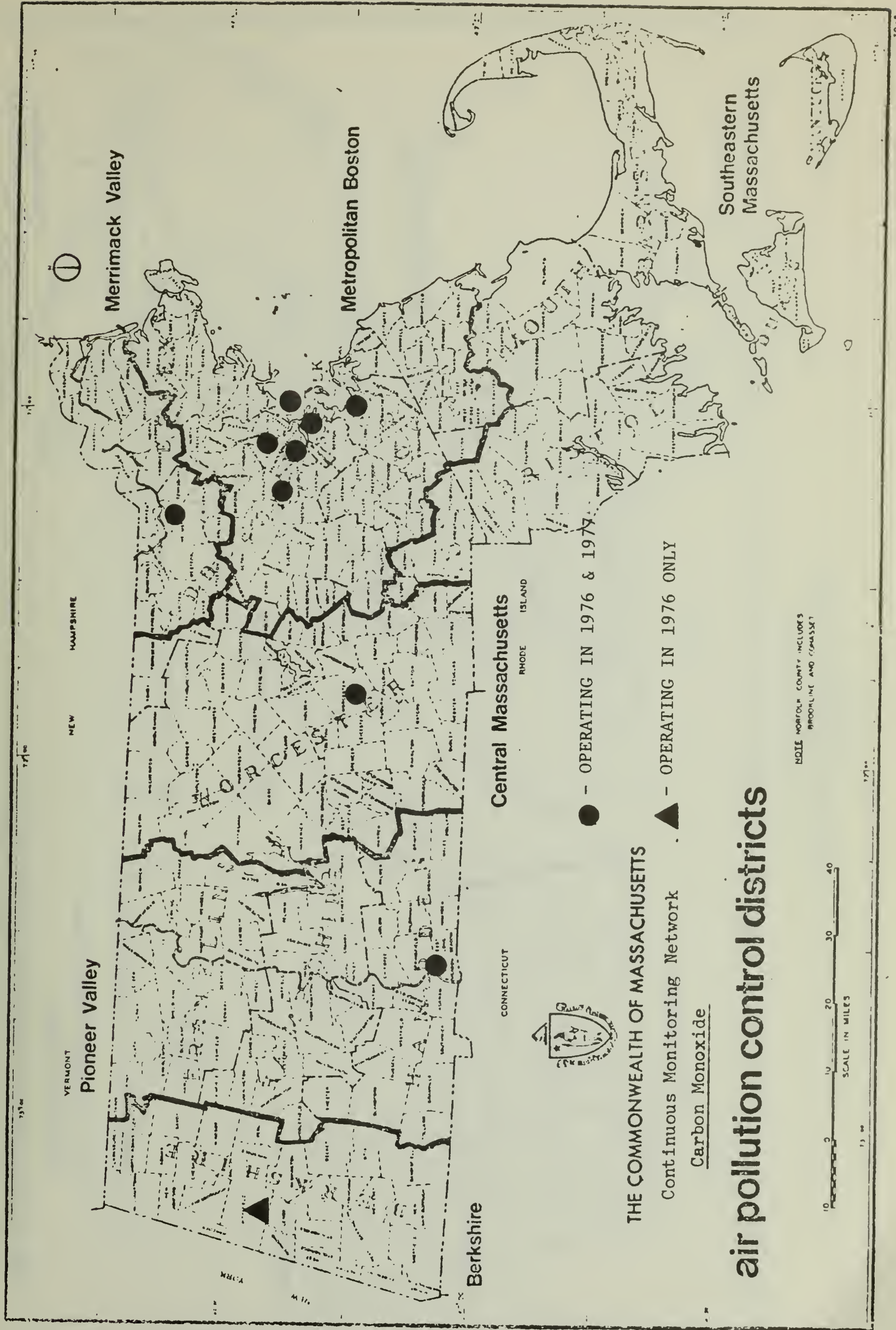


FIGURE 7
CONTINUOUS MONITORING NETWORK
NITROGEN DIOXIDE

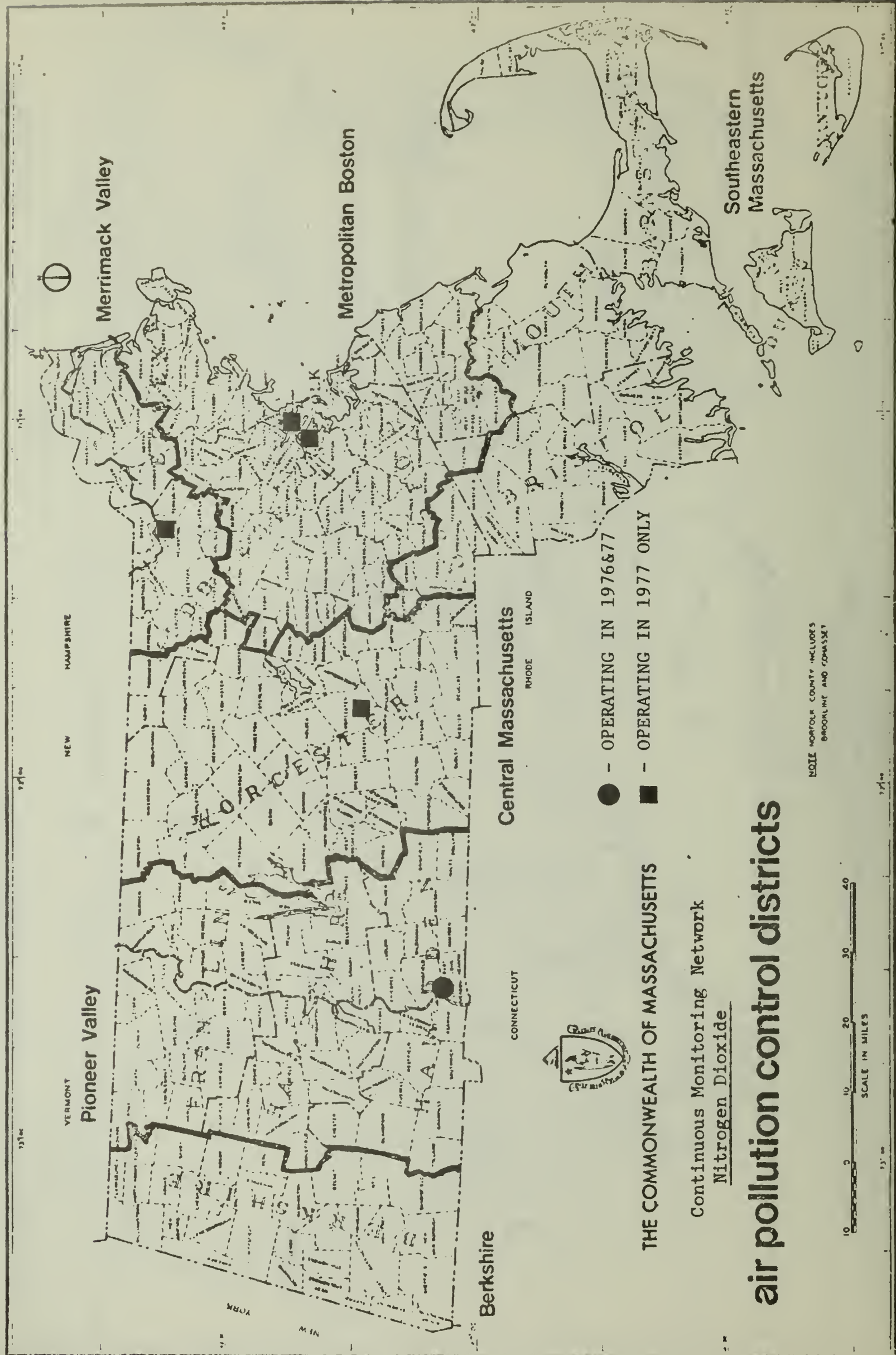


FIGURE 8
CONTINUOUS MONITORING NETWORK
OZONE

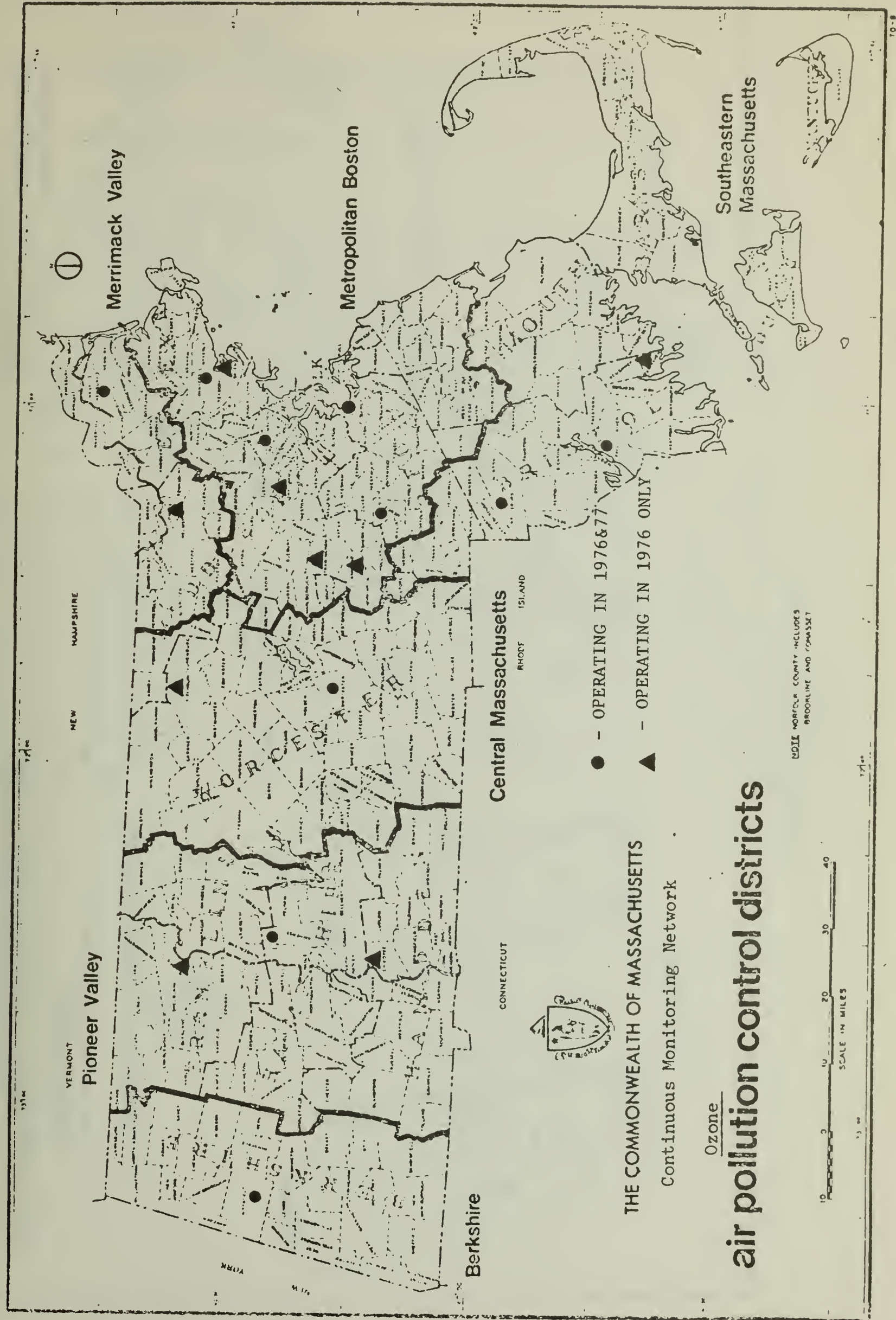
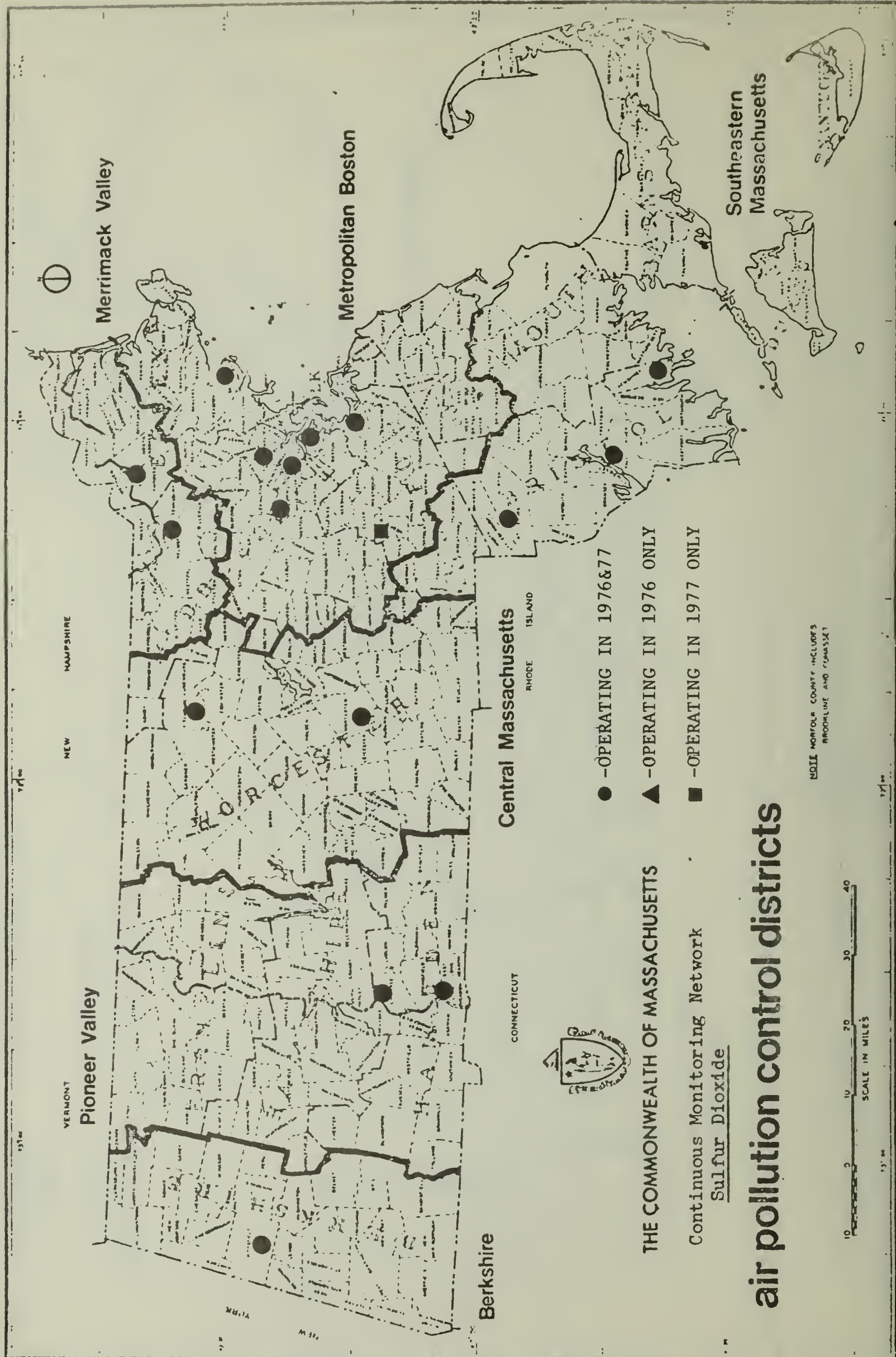


FIGURE 9
CONTINUOUS MONITORING NETWORK
SULFUR DIOXIDE



Section 6 - Sampling History for Continuous Data 1976 and 1977

6.1 Sulfur Dioxide (SO₂)

6.1.1 Conclusions

As presented in Tables 8 and 9 all continuous SO₂ monitors in the state are presently meeting the National Ambient Air Quality Standard for Sulfur Dioxide. The continued restrictions upon fuel sulfur content are responsible for successful state wide compliance with sulfur dioxide standards.

6.1.2 Sample Collection and Analysis

DAHM uses two instrumental methods for analysis of continuous sulfur dioxide concentrations. The manufacturers of this equipment are: Philips Electronic Inc., (Philips PW 9700), and Thermo Electron Inc. (Teco Model 43). The Philips instrument employs coulometric titration as its measurement principle while TECO uses pulsed fluorescent detection as its measurement principle. Both analytical methodologies meet equivalency requirements as published in the Environmental Protection Agency in Part 53, 40 CFR, February 18, 1975.

TABLE 8

1976 CONTINUOUS SO₂ SUMMARY

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORK

SULFUR DIOXIDE (SO₂) method: INSTRUMENTAL COULOMETRIC units: PARTS PER BILLION (ppb)

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF HOURLY OBS.	ANNUAL ARITH. MEAN	MAXIMUM 24 hr OBSERVATION	2nd MAX 24 hr OBSERVATION	MAXIMUM 3 hr OBSERVATION	2nd MAX 3 hr OBSERVATION
SITE LOCATION								
<u>BERKSHIRE AIR QUALITY CONTROL REGION (117)</u>								
PITTSFIELD	1800-004	BK-03	7452	9	48	41	104	88
DALTON AVE., STATE POLICE								
<u>CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)</u>								
FITCHBURG	0620-003	CM-13	8128	9	39	31	55	55
G & E SUBSTA., SUMMER ST.								
WORCESTER	2640-012	CM-11	8579	12	46	46	82	79
WASHINGTON & NEW SALEM STS								
<u>MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)</u>								
LAWRENCE	1000-003	MV-10	8242	16	66	59	108	101
LAWRENCE GENERAL HOSPITAL								
LOWELL	1080-004	MV-09	7781	10	46	42	69	64
JOHN STREET MUNIC GARAGE								
<u>METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)</u>								
BOSTON	0240-002	MB-01	7651	19	69	62	133	112
KENMORE SQUARE								
CAMBRIDGE	0360-004	MB-05	2498	ID	64	46	94	89
SCIENCE PARK								
MEDFORD	1220-003	MB-19	7920	13	70	45	129	81
WELLINGTON CIRCLE								
QUINCY	1880-002	MB-21	7087	10	44	38	110	81
FORE RIVER BRIDGE								
SALEM	1980-001	MB-27	7295	9	54	41	67	63
HIGHLAND AVENUE								
WALTHAM	2340-004	MB-20	8115	10	41	38	57	54
MAIN & MOODY STREETS								
(continued)								

ID - UNEVEN DISTRIBUTION OF SAMPLES WITHIN THE YEAR PREVENTS ACCURATE
CALCULATION OF ANNUAL ARITHMETIC MEAN

TABLE 8 (cont)

1976 CONTINUOUS SO₂ SUMMARYDEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORK

units: (ppb)

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF HOURLY OBS.	ANNUAL ARITH. MEAN	MAXIMUM 24 hr OBSERVATION	2nd MAX 24 hr OBSERVATION	MAXIMUM 3 hr OBSERVATION	2nd MAX 3 hr OBSERVATION
SITE LOCATION								
<u>PIONEER VALLEY AIR QUALITY CONTROL REGION (042)</u>								
CHICOPEE	0400-005	PV-14	7792	9	63	44	83	73
CHICOPEE STREET								
SPRINGFIELD	2160-005	PV-06	7851	12	65	54	112	93
EAST COLUMBUS AVENUE								
<u>SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)</u>								
ATTLEBORO	0120-003	SE-10	3196	ID	30	23	49	45
LaSALLETTES SHRINE, PARK ST.								
FAIRHAVEN	0570-001	SE-08	7870	6	29	28	84	70
TOWN WHARF, MIDDLE STREET								
FALL RIVER	0580-004	SE-06	8378	5	30	24	52	47
GLOBE STREET TRAILER								

ID - UNEVEN DISTRIBUTION OF SAMPLES WITHIN THE YEAR PREVENTS ACCURATE
CALCULATION OF THE ANNUAL ARITHMETIC MEAN

TABLE 9

1977 CONTINUOUS SO₂ SUMMARY

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORK

SULFUR DIOXIDE (SO₂) method: INSTRUMENTAL COULOMETRIC units: PARTS PER BILLION (ppb)

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF HOURLY OBS.	ANNUAL ARITH. MEAN	MAXIMUM 24 hr OBSERVATION	2nd MAX 24 hr OBSERVATION	MAXIMUM 3 hr OBSERVATION	2nd MAX 3 hr OBSERVATION
SITE LOCATION								
<u>BERKSHIRE AIR QUALITY CONTROL REGION (117)</u>								
PITTSFIELD	1800-004	BK-03	7629	8	64	50	133	96
DALTON AVE., STATE POLICE								
<u>CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)</u>								
FITCHBURG	0620-003	CM-13	8477	10	44	43	72	68
G & E SUBSTA., SUMMER ST.								
WORCESTER	2640-012	CM-11	8511	11	57	53	105	93
WASHINGTON & NEW SALEM STS.								
<u>MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)</u>								
LAWRENCE	1000-003	MV-10	7969	13	60	58	110	106
LAWRENCE GENERAL HOSPITAL								
LOWELL	1080-004	MV-09	8471	9	48	41	77	66
JOHN STREET MUNIC. GARAGE								
<u>METROPOLITAN BOSTON AIR QUALITY REGION (119)</u>								
BOSTON	0240-002	MB-01	6950	20	61	59	106	100
KENMORE SQUARE								
CAMBRIDGE	0360-004	MB-05	8036	12	56	51	101	100
SCIENCE PARK								
QUINCY	1880-002	MB-21	8088	12	83	60	283	260
FORE RIVER BRIDGE								
MEDFIELD	1210-001	MB-28	782	ID	25	20	50	49
STATE HOSPITAL								
MEDFORD	1220-003	MB-19	8227	14	52	41	99	43
WELLINGTON CIRCLE								
SALEM	1980-001	MB-27	3336	13*	59	55	92	87
HIGHLAND AVENUE								
WALTHAM	2340-004	MB-20	7493	9	42	40	62	61
MAIN AND MOODY STS.								

(continued)

* THIS ARITHMETIC MEAN IS AN OVER ESTIMATE SINCE NO SUMMER SAMPLES WERE TAKEN

TABLE 9 (cont)

1977 CONTINUOUS SO₂ SUMMARYSULFUR DIOXIDE (SO₂)

units: ppb

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF HOURLY OBS.	ANNUAL ARITH. MEAN	MAXIMUM 24 hr OBSERVATION	2nd MAX 24 hr OBSERVATION	MAXIMUM 3 hr OBSERVATION	2nd MAX 3 hr OBSERVATION
SITE LOCATION								
<u>PIONEER VALLEY AIR QUALITY CONTROL REGION (042)</u>								
CHICOPEE	0400-005	PV-14	8258	11	52	49	82	77
CHICOPEE STREET								
SPRINGFIELD	2160-005	PV-06	8420	14	55	50	92	74
EAST COLUMBUS AVENUE								
<u>SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)</u>								
ATTLEBORO	0120-003	SE-10	7524	5	34	30	68	57
LaSALLETTES SHRINE, PARK ST.								
FAIRHAVEN	0570-001	SE-08	1516	ID	41	35	61	60
TOWN WHARF, MIDDLE ST.								
FALL RIVER	0580-004	SE-06	8158	7	42	28	104	61
GLOBE STREET TRAILER								

ID - UNEVEN DISTRIBUTION OF SAMPLES WITHIN THE YEAR PREVENTS ACCURATE
CALCULATION OF ANNUAL ARITHMETIC MEAN

6.2 Carbon Monoxide (CO)

6.2.1 Conclusions

Violations of the 8 hour CO standard were observed for 1976 and 1977 in Central Massachusetts, Metropolitan Boston and Pioneer Valley Regions at each sampling site within these regions. No violations of the 1 hour CO standard were observed in this time period. Tables 10 and 11 summarize the CO data. Figure 10 shows five year CO history at selected sites. The decline in CO violations is obvious, and may be attributed to the new car emissions controls.

6.2.2 Sample Collection and Analysis

DAHM uses two manufacturers models of Non-Dispersive Infrared (NDIR) analyzers for Carbon Monoxide detection. The respective manufacturers are Ethyl Intertek, Inc., and Horiba Instruments, Inc. Both instruments employ a short cell NDIR detection principle coupled with water vapor subtraction. Neither of these instruments has yet to be determined as meeting equivalency requirements as published in Part 53, 40 CFR, February 18, 1975.

It is noted that this instrumentation was purchased prior to the publication of the equivalency requirements dated above. DAHM is currently evaluating the feasibility of performing the necessary testing required to meet equivalency specifications versus the cost of replacing the entire CO network with new equipment. According to federal guidelines, all measurement techniques used to determine compliance with National Ambient Air Quality Standards must meet the provisions of Part 53, 40 CFR, February 18, 1975 by 1980.

TABLE 10

1976 CO SUMMARYDEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORK

CARBON MONOXIDE (CO) method: Non-dispersive Infra-red units: Parts per Million

CITY	SAROAD I.D.	DIST I.D.	# OF 1hr OBS	# OF 8hr AVGS ABOVE 9	# OF DAYS w/8hr AVG ABOVE 9	MAX 1hr OBS	2nd MAX 1hr OBS	MAX 8hr OBS	2nd MAX 8hr OBS
<u>BERKSHIRE AIR QUALITY CONTROL REGION (117)</u>									
PITTSFIELD DALTON AVE., STATE POLICE	1800-004	BK-03	5659	0	0	13	12	6.6	5.8
<u>CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)</u>									
WORCESTER WASHINGTON & NEW SALEM STS	2640-012	CM-11	8369	19	17	18	16	13.1	11.9
<u>MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)</u>									
LOWELL JOHN STREET MUNIC. GARAGE	1080-004	MV-09	6894	1	1	22	12	10.1	7.9
<u>METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)</u>									
BOSTON KENMORE SQUARE	0240-002	MB-01	8119	63	47	23	21	16.6	16.1
EAST BOSTON CALLAHAN TUNNEL	0240-016	MB-25	6680	19	17	25	20	15.3	14.9
CAMBRIDGE SCIENCE PARK	0360-004	MB-05	1817	3	3	17	16	11.4	11.3
MEDFORD WELLINGTON CIRCLE	1220-003	MB-19	7945	9	9	24	24	16.0	13.3
QUINCY FORE RIVER BRIDGE	1880-002	MB-21	6469	2	1	20	20	13.4	8.6
WALTHAM MOODY AND MAIN STREETS	2340-004	MB-20	7091	5	5	25	19	14.1	10.5
<u>PIONEER VALLEY AIR QUALITY CONTROL REGION (042)</u>									
SPRINGFIELD EAST COLUMBUS AVENUE	2160-005	PV-06	7625	54	46	20	19	14.6	12.5

TABLE 11

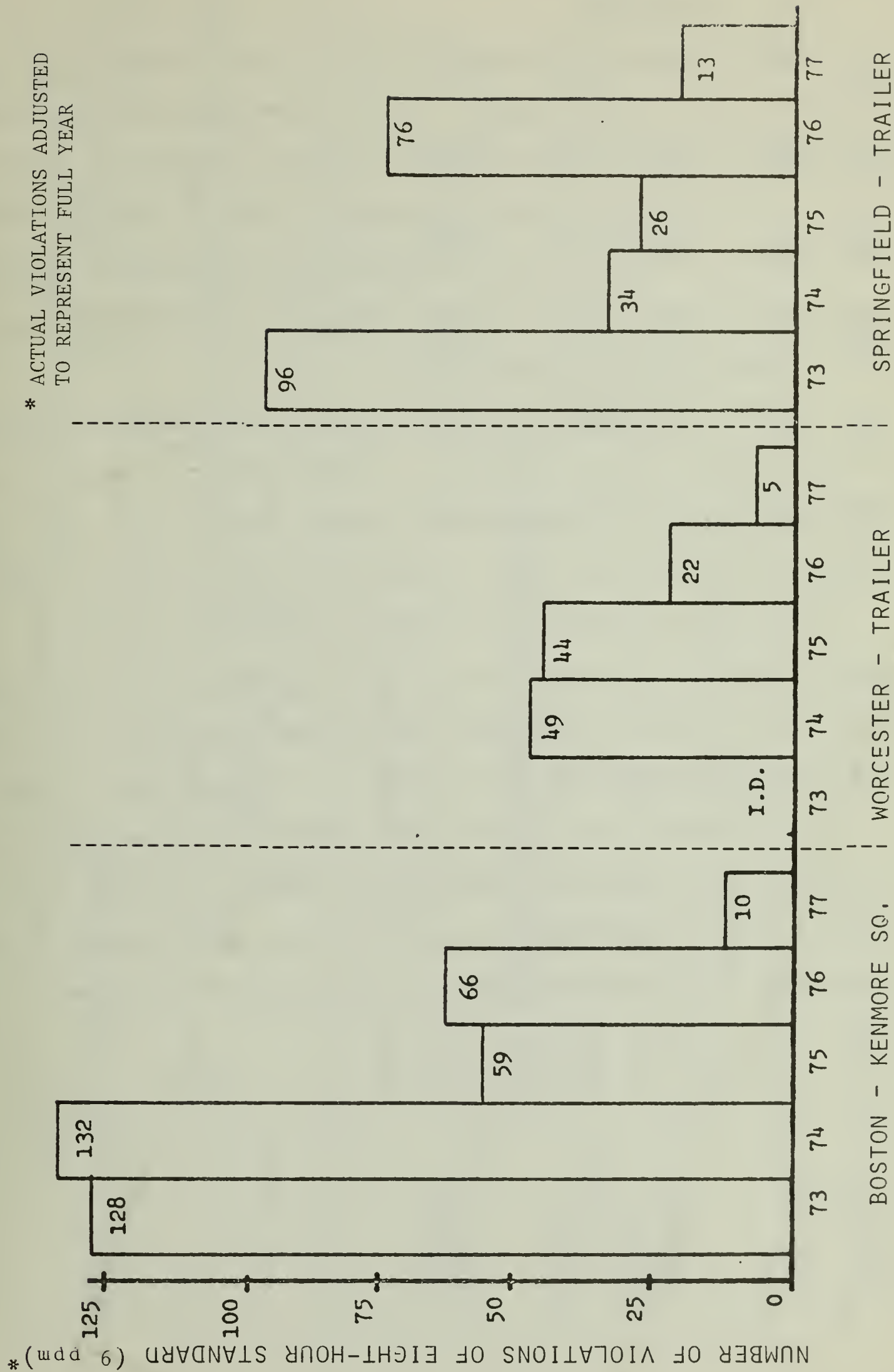
1977 CO SUMMARYDEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORK

CARBON MONOXIDE (CO) method: Non-dispersive Infra-red units: Parts per Million

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF HOURLY OBS.	# OF 8hr AVGS ABOVE 9	# OF DAYS w/8hr AVGS ABOVE 9	MAX 1hr OBS	2nd MAX 1hr OBS	MAX 8hr OBS	2nd MAX 8hr OBS
SITE LOCATION									
<u>CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)</u>									
WORCESTER WASHINGTON & NEW SALEM STS	2640-012	CM-11	7519	5	5	29	26	15.4	10.5
<u>MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)</u>									
LOWELL JOHN STREET MUNIC. GARAGE	1080-004	MV-09	7411	0	0	13	13	9.0	8.9
<u>METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)</u>									
BOSTON KENMORE SQUARE	0240-002	MB-01	7919	9	8	25	21	14.4	12.6
EAST BOSTON CALLAHAN TUNNEL	0240-016	MB-25	6294	5	4	26	21	11.4	11.1
CAMBRIDGE SCIENCE PARK	0360-004	MB-05	7826	5	5	18	16	11.1	9.8
MEDFORD WELLINGTON CIRCLE	1220-003	MB-19	8232	8	8	22	21	13.5	12.9
QUINCY FORE RIVER BRIDGE	1880-002	MB-21	8354	2	2	15	14	11.4	9.5
WALTHAM MOODY AND MAIN STREETS	2340-004	MB-20	7736	6	6	24	22	13.8	10.6
<u>PIONEER VALLEY AIR QUALITY CONTROL REGION (042)</u>									
SPRINGFIELD EAST COLUMBUS AVENUE	2160-005	PV-06	8276	12	12	18	17	11.0	10.4

FIGURE 10

CARBON MONOXIDE HISTORY AT SELECTED SITES



6.3 Ozone (O₃)

6.3.1 Conclusions

All sites within the network continue to show violation of the photochemical oxidant (ozone) standard. In fact, DAHM has never measured ozone at a site which did not record a standard violation at least once during a summer season. This demonstrates the pervasiveness of this air quality problem in Massachusetts. Tables 12 and 13 contain the ozone summaries. Figure 11 shows the five year ozone history for four sites and no definite trends are evident.

6.3.2 Sample Collection and Analysis

Continuous measurement of ozone is made by instruments utilizing the chemiluminescent detection principle. In this method, the ozone is reacted chemically with ethylene gas and the resultant compound emits light. The intensity of the emitted light is proportional to the amount of ozone contained.

Within the DAHM network the following manufacturers' models of Chemiluminescent detectors are used: Monitor Labs-ML 8410A, Bendix-8101B. Neither manufacturers' instruments have yet been determined to meet equivalency requirements as published by EPA in Part 53, 40 CFR, February 18, 1975.

As is the case with carbon monoxide equipment, these analyzers were purchased prior to the federal equivalency guidelines. However, it is believed that minor modifications and upgrading to this equipment by the manufactures will allow the equipment to be determined equivalent.

TABLE 12

1976 O₃ SUMMARY

APRIL TO OCTOBER

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING -- MASSACHUSETTS AIR SURVEILLANCE NETWORK

OZONE (O₃) method: CHEMILUMINESCENCE units: PARTS PER BILLION (ppb)

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF HOURLY OBS.	# OF HRS ABOVE 80	# OF DAYS ABOVE 80	MAXIMUM HOUR AND 2nd MAXIMUM HOUR BY MONTH						
						APR	MAY	JUN	JUL	AUG	SEP	OCT
SITE LOCATION												
<u>BERKSHIRE AIR QUALITY CONTROL REGION (117)</u>												
PITTSFIELD	1800-004	BK-03	5008	284	44	123 117	94 90	138 135	128 126	139 138	108 107	70 65
<u>CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)</u>												
FITCHBURG	0620-003	CM-13	4993	245	43	138 110	115 109	159 158	181 170	138 131	120 114	60 60
G & E SUBSTA., SUMMER ST												
WORCESTER	2640-012	CM-11	5005	176	36	130 121	90 88	147 135	202 161	187 162	85 83	48 48
WASHINGTON & NEW SALEM STS												
<u>MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)</u>												
LOWELL	1080-004	MV-09	4875	159	28	149 148	84 81	179 149	143 113	158 136	87 87	54 51
JOHN STREET MUNIC. GARAGE												
WEST NEWBURY	2467-001	MV-11	4147	337	53	125 110	120 120	115 110	170 160	210 200	115 105	ND
REGIONAL JR HIGH SCHOOL												(continued)

ND - NO DATA FOR THESE MONTHS

TABLE 12 (cont)

1976 O₃ SUMMARY

units:(ppb)

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF HOURLY OBS	# OF HRS ABOVE 80	# OF DAYS ABOVE 80	MAXIMUM HOUR AND 2nd MAXIMUM HOUR BY MONTH						
						APR	MAY	JUN	JUL	AUG	SEP	OCT
SITE LOCATION												
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)												
ASHLAND	0092-001	MB-30	3718	291	47	ND	ND	178 145	218 180	171 167	96 95	80 78
4-H CNTR., CHESTNUT ST.												
DANVERS	0480-002	MB-29	4664	265	35	113 95	95 95	155 150	192 165	ND	123 110	70 70
ESSEX AGRICULTURAL INST												
FRAMINGHAM	0660-002	MB-24	1536	93	11	170 170	125 125	113 107	ND	ND	ND	ND
C.D. HDQTRS, WORCESTER RD												
MEDFIELD	1210-001	MB-28	4043	181	53	76 75	116 110	183 158	228 208	126 126	120 119	81 80
STATE HOSPITAL												
MEDFORD	1220-003	MB-19	4502	66	16	46 42	73 70	112 110	164 135	160 157	78 77	43 39
WELLINGTON CIRCLE												
QUINCY	1880-002	MB-21	4794	285	50	92 86	95 90	156 140	182 155	176 146	97 97	63 63
FORE RIVER BRIDGE												
SALEM	1980-001	MB-27	4625	122	29	130 123	87 85	170 160	123 116	175 165	125 115	56 54
HIGHLAND AVENUE												
WALTHAM	2340-004	MB-12	3730	191	29	60 58	60 60	165 150	235 183	155 156	90 87	28 26
U. MASS. FIELD STATION												
(continued)												

(continued)

ND - NO DATA FOR THESE MONTHS

TABLE 12 (cont)

1976 O₃ SUMMARY

units: (ppb)

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF HOURLY OBS.	# OF HRS ABOVE 80	# OF DAYS ABOVE 80	MAXIMUM HOUR AND 2nd MAXIMUM HOUR BY MONTH						
						APR	MAY	JUN	JUL	AUG	SEP	OCT
SITE LOCATION												
PIONEER VALLEY AIR QUALITY CONTROL REGION (042)												
AMHERST	0060-001	PV-10	4702	217	39	125 117	119 102	188 156	179 166	212 180	135 135	80 78
UNIVERSITY OF MASSACHUSETTS												
CHICOPEE	0400-004	PV-12	4935	240	42	170 125	111 92	188 178	180 180	175 176	145 140	70 68
80 MEDINA ST, WTR TREATMENT PLANT												
GREENFIELD	0780-002	PV-13	3505	164	41	80 75	102 94	187 167	160 160	200 190	110 188	ND
WATER TREATMENT PLANT												
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)												
ATTLEBORO	0120-003	SE-10	2367	121	24	ND	ND	ND	173 168	145 131	111 111	74 73
LaSALLETTTE SHRINE, PARK ST.												
FAIRHAVEN	0570-001	SE-08	4469	263	52	150 138	118 115	195 148	220 184	145 138	165 165	70 70
TOWN WHARF, MIDDLE STREET												
FALL RIVER	0580-004	SE-06	2471	154	25	135 125	88 87	173 165	143 129	ND	ND	ND
GLOBE STREET TRAILER												

ND - NO DATA FOR THESE MONTHS

TABLE 13

1977 O₃ SUMMARYDEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORK

OZONE (O ₃)		method: CHEMILUMINESCENCE		units: Parts per Billion (ppb)									
CITY	SAROAD I.D.	DIST I.D.	NUMBER OF HOURLY OBS.	# OF HRS ABOVE 80	# OF DAYS ABOVE 80	MAXIMUM HOUR AND 2nd MAXIMUM HOUR BY MONTH							
SITE LOCATION						APR	MAY	JUN	JUL	AUG	SEP	OCT	
<u>BERKSHIRE AIR QUALITY CONTROL REGION (117)</u>													
PITTSFIELD	1800-004	BK-04	3951	46	12	75 75	78 75	128 125	90 90	120 105	85 83	50 49	
DALTON AVE., STATE POLICE													
<u>CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)</u>													
WORCESTER	2640-012	CM-11	4469	142	29	95 80	140 130	101 91	149 143	113 105	57 56	50 47	
WASHINGTON & NEW SALEM STS													
<u>MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)</u>													
WEST NEWBURY	2467-001	MV-11	3800	302	46	67 67	225 210	170 156	116 108	147 145	73 72	69 63	
REGIONAL JR. HIGH SCHOOL													
<u>METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)</u>													
DANVERS	0480-002	MB-29	2967	109	23	81 80	130 120	105 100	140 135	125 120	ND	ND	
ESSEX AGRICULTURAL INST.													
MEDFIELD	1210-001	MB-28	1927	72	11	ND	ND	ND	145 140	ND	80 80	78 73	
STATE HOSPITAL													
MEDFORD	1220-003	MB-19	4831	110	21	65 63	98 92	91 88	170 165	140 110	60 59	40 37	
WELLINGTON CIRCLE													
QUINCY	1880-002	MB-21	4721	264	46	100 100	136 135	125 120	150 150	137 130	90 85	60 55	
FORE RIVER BRIDGE													
ND - No data for these months													(continued)

TABLE 13 (cont)

1977 O₃ SUMMARY

units: ppb

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF HOURLY OBS.	# OF HRS ABOVE 80	# OF DAYS ABOVE 80	MAXIMUM HOUR AND 2nd MAXIMUM HOUR BY MONTH						
						APR	MAY	JUN	JUL	AUG	SEP	OCT
PIONEER VALLEY AIR QUALITY CONTROL REGION (042)												
AMHERST UNIV. OF MASSACHUSETTS	0060-001	PV-10	4552	169	33	105 100	145 145	132 130	120 110	140 140	75 65	52 50
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)												
ATTLEBORO La SALLETTA SHRINE, PARK ST.	0120-003	SE-10	4006	66	19	ND	114 113	114 104	135 125	97 90	66 65	50 48
FALL RIVER GLOBE ST TRAILER	0580-004	SE-06	4743	223	41	106 100	150 150	121 93	150 150	145 144	135 105	59 57

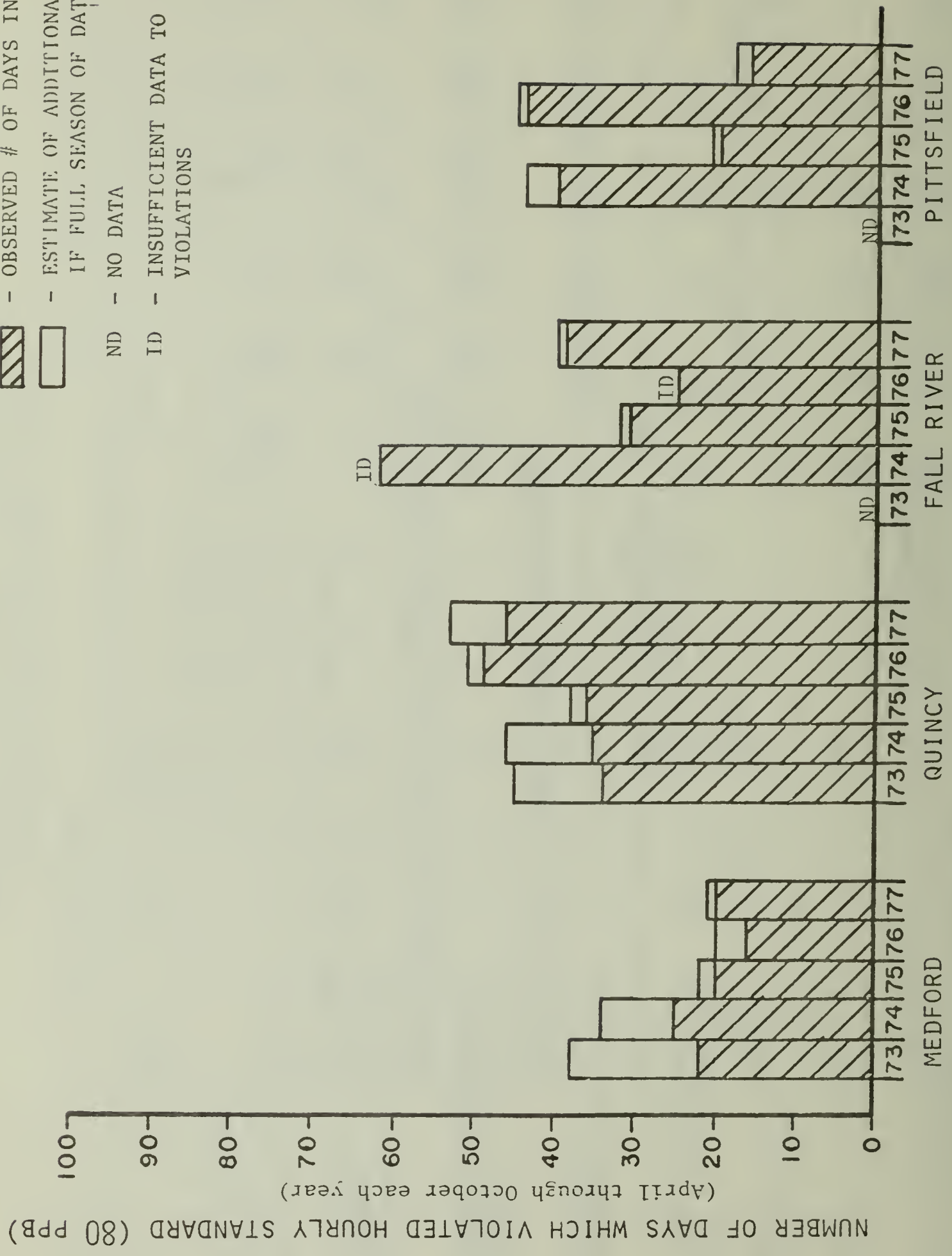
ND - NO DATA AVAILABLE FOR THESE MONTHS

FIGURE 11

OZONE HISTORY AT SELECTED SITES

KEY

- OBSERVED # OF DAYS IN VIOLATION
- ESTIMATE OF ADDITIONAL VIOLATIONS IF FULL SEASON OF DATA
- ND - NO DATA
- ID - INSUFFICIENT DATA TO ESTIMATE VIOLATIONS



6.4 Nitrogen Dioxide (NO₂)

6.4.1 Conclusions

The data base is very sparse for NO₂ for years 1976 and 1977 because of the lack of continuous measurement equipment. Therefore, no comparison with the annual standard for this pollutant will be made. However, DAHM believes that continued operation of this network will show compliance with the current annual NO₂ standard. Table 14 contains the NO₂ summary.

6.4.2 Sample Collection and Analysis

Continuous measurement of Nitrogen Dioxide (NO₂) is made using the chemiluminescent detection principle. In this method, nitric oxide (NO) and oxides of nitrogen (NO_x) are reacted with ozone and the resultant chemical products emit light i.e., luminesces. As in the case with ozone analyzers this amount of light emitted is proportional to the amount of NO and NO_x, the result being NO₂.

Two manufacturers' models of chemiluminescent NO-NO_x analyzers are used in the DAHM network. These are: Thermo Electron Corp. - Model 14D and Monitor Lab., Inc. - Model 8440.

TABLE 14

1976 and 1977 CONTINUOUS NO₂ SUMMARYDEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORK

NITROGEN

DIOXIDE (NO₂) method: CHEMILUMINESCENCE units: Parts per Billion (ppb)

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF HOURLY OBS.	ARITH. MEAN	MAX 24hr OBS	2nd MAX 24hr OBS	MAX 1hr OBS	2nd MAX 1hr OBS
SITE LOCATION								
<u>1976</u>								
SPRINGFIELD	2160-005	PV-06	4819	44	93	91	185	180
EAST COLUMBUS AVENUE								
<u>1977</u>								
BOSTON	0240-002	MB-01	1702	41	79	64	125	120
KENMORE SQUARE								
EAST BOSTON	0240-016	MB-25	5710	30	69	67	121	112
CALLAHAN TUNNEL								
LOWELL	1080-004	MV-09	5926	27	103	70	275	255
JOHN STREET MUNIC. GARAGE								
WORCESTER	2640-012	CM-11	4730	40	110	75	170	167
WASHINGTON & NEW SALEM STS								
SPRINGFIELD	2160-005	PV-06	7749	45	101	96	210	195
EAST COLUMBUS AVENUE								

7.1 Sulfur Dioxide

7.1.1 Conclusions

DAHM operated an extensive SO₂ non-continuous (bubbler) network during 1976 and 1977 on a frequency of one day every sixth day. The results from this network show compliance with the 24 hour and annual standard throughout the state for this pollutant. The months of July, August, and September were not sampled in 1977 because the sampling techniques is not valid when ambient temperatures exceed 70°F. Tables 15 and 16 contain the SO₂ summaries. Figures 12 is a plot of SO₂ annual means from 1970 through 1977 for six sites.

7.1.2 Sample Collection and Analysis

Sulfur dioxide measurements were made using the gas impingement train (Research Appliance Corp. - Model 2333A). In this method sulfur dioxide is impinged through a specific collection agent and absorbed chemically. At the end of the collection period, the sample is transferred to a laboratory where color producing chemicals are added to react with the absorbed sulfur dioxide. The intensity of the color produced is proportional to the amount of sulfur dioxide absorbed in the sample. Thus knowing the air flow rate, the sample time, and the amount of SO₂ collected, a concentration in parts per million (ppm) is derived. The specific chemical method used is referred to as the West Gaeke Procedure and is the Federal Reference Method for SO₂ detection.

TABLE 15

1976 SO₂ BUBBLER SUMMARYDEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORKSULFUR DIOXIDE (SO₂) method: WEST-GAEKE units: PARTS PER BILLION (ppb)

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH. MEAN	GEOM STANDARD DEV.	MAXIMUM 24hr OBS	2nd MAXIMUM 24 hr OBS
SITE LOCATION							
BERKSHIRE AIR QUALITY CONTROL REGION (117)							
ADAMS	0020-001	BK-07	56	7	3.48	36	32
SEWAGE TREATMENT PLANT							
LEE	1020-001	BK-06	58	BDL	2.42	23	17
SEWAGE TREATMENT PLANT							
NORTH ADAMS	1580-002	BK-08	58	9	3.34	39	37
HOLDEN STREET							
PITTSFIELD	1800-002	BK-04	61	15	4.00	86	60
HIBBARD SCHOOL							
PITTSFIELD	1800-004	BK-03	61	8	3.34	45	43
DALTON AVE STATE POLICE							
CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)							
ATHOL	0100-001	CM-08	59	6	2.84	45	35
CITY HALL							
FITCHBURG	0620-002	CM-12	19	ID	2.42	41	34
CITY HALL							
FITCHBURG	0620-003	CM-13	60	7	2.80	30	23
G&E SUBSTA., SUMMER ST.							
FITCHBURG	0620-004	CM-14	58	7	3.12	41	31
WATER ST. FIRE STATION							
FITCHBURG	0620-006	CM-16	38	ID	2.15	9	8
GAS AND ELECTRIC BUILDING							
WARREN	2372-001	CM-10	58	BDL	2.14	12	9
HIGH SCHOOL							
WORCESTER	2640-004	CM-02	57	11	3.48	41	32
NARCUS DEPARTMENT STORE							
WORCESTER	2640-008	CM-01	60	6	3.07	44	35
CLARK UNIVERSITY							
WORCESTER	2640-009	CM-07	58	9	3.22	44	34
PARKER BUILDING							
WORCESTER	2640-012	CM-11	60	11	3.21	43	39
WASHINGTON & NEW SALEM STS.							
WORCESTER	2640-013	CM-15	60	7	2.82	29	27
HEALTH DEPARTMENT							

(continued)

TABLE 15 (cont)

1976 SO₂ BUBBLER SUMMARYSULFUR DIOXIDE (SO₂) method: WEST-GAFKE units: PARTS PER BILLION (ppb)

CITY SITE LOCATION	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH. MEAN	GEOM STANDARD DEV.	MAXIMUM 24 hr OBS	2nd MAXIMUM 24 hr OBS
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)							
BOSTON JFK FEDERAL BUILDING	0240-001	MB-02	41	8	2.25	29	26
BOSTON KENMORE SQUARE	0240-002	MB-01	55	10	2.79	31	27
BOSTON SOUTH BAY	0240-012	MB-04	19	ID	2.31	25	24
BROOKLINE HIGH SCHOOL	0340-001	MB-17	53	6	3.17	41	25
CAMBRIDGE HARVARD HERBARIUM	0360-001	MB-11	49	4	2.67	25	14
CAMBRIDGE SCIENCE PARK	0360-004	MB-05	15	ID	2.45	50	36
FRAMINGHAM MIDDLESEX COUNTY COURT	0660-001	MB-14	50	5	2.90	34	24
LYNN CITY HALL	1100-001	MB-06	45	10	3.06	88	31
MARBLEHEAD JUNIOR HIGH SCHOOL	1160-001	MB-07	50	BDL	2.66	21	19
MAYNARD ARMY METEOROLOGY TEAM	1200-001	MB-13	36	BDL	2.52	25	12
MEDFORD FIRE HEADQUARTERS	1220-002	MB-08	50	10	3.09	110	29
MEDFORD WELLINGTON CIRCLE	1220-003	MB-19	55	10	2.86	58	32
NEEDHAM GLOVER MEMORIAL HOSP	1480-003	MB-33	42	5	2.69	17	13
NORWOOD NAHATAN ST FIRE STATION	1700-001	MB-18	48	7	2.45	21	20
QUINCY FORE RIVER BRIDGE	1880-002	MB-21	47	10	3.04	33	27
QUINCY ATLANTIC FIRE STATION	1800-007	MB-31	9	ID	2.14	27	16
REVERE GARFIELD JUNIOR HIGH	1940-002	MB-10	50	11	3.08	47	38

(continued)

1976 SO₂ BUBBLER SUMMARY

units: ppb

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH. MEAN	GEOM STANDARD DEV.	MAXIMUM 24hr OBS.	2nd MAXIMUM 24 hr OBS
SITE LOCATION							

METROPOLITAN BOSTON AOCR (cont.)

WALTHAM	2340-003	MB-12	38	BDL	2.59	30	15
U. MASS. FIELD STATION							
WALTHAM	2340-004	MB-20	50	9	3.00	37	35
MAIN AND MOODY STREETS							
WOBURN	2620-002	MB-09	24	ID	2.07	11	7
MIDDLESEX COUNTY COURT							

MERRIMACK VALLEY AIR POLLUTION CONTROL REGION (121)

AYER	0140-001	MV-06	58	7	2.81	62	28
DISTRICT COURT HOUSE							
HAVERHILL	0840-001	MV-02	55	7	2.79	24	22
MUNICIPAL BUILDING							
LAWRENCE	1000-003	MV-10	57	8	3.27	48	46
LAWRENCE GENERAL HOSPITAL							
LOWELL	1080-001	MV-04	57	8	3.10	34	33
HIGH SCHOOL							
LOWELL	1080-003	MV-07	53	5	2.99	31	21
FATHER NORTON MANOR							
LOWELL	1080-004	MV-09	55	9	3.01	41	31
JOHN ST. MUNICIPAL GARG.							
NEWBURYPORT	1520-002	MV-08	56	6	2.57	27	23
SULLIVAN BUILDING							

PIONEER VALLEY AIR POLLUTION CONTROL REGION (042)

CHICOPEE	0400-001	PV-03	61	10	3.38	36	29
CITY HALL							
CHICOPEE	0400-003	PV-07	60	8	2.94	54	38
MEADOW STREET							
CHICOPEE	0400-005	PV-14	56	8	3.10	38	28
CHICOPEE STREET							
GREENFIELD	0780-002	PV-13	59	5	3.14	36	36
WATER TREATMENT PLANT							
SPRINGFIELD	2160-002	PV-02	60	12	3.09	70	39
MILL STREET							
SPRINGFIELD	2160-003	PV-01	56	11	3.13	91	40
TAYLOR ST. FIRE STATION							
SPRINGFIELD	2160-005	PV-06	58	11	2.82	57	46
EAST COLUMBUS AVENUE							

(continued)

TABLE 15 (cont)

1976 SO₂ BUBBLER SUMMARY

units: ppb

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH. MEAN	GEOM STANDARD DEV.	MAXIMUM 24 hr OBS	2nd MAXIMUM 24 hr OBS
SITE LOCATION							
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)							
ATTLEBORO	0120-002	SE-05	54	8	2.51	23	23
SO. MAIN ST. FIRE STATION							
FALL RIVER	0580-001	SE-04	53	6	2.76	21	19
CENTRAL FIRE STATION							
FALL RIVER	0580-004	SE-06	54	BDL	2.37	14	14
GLOBE STREET TRAILER							
FALMOUTH	0600-001	SE-02	38	ID	2.20	11	11
FIRE STATION							
NEW BEDFORD	1500-002	SE-03	54	BDL	2.51	15	15
HIGH SCHOOL							
PLYMOUTH	1820-001	SE-01	52	BDL	2.16	11	10
FIRE STATION							
TAUNTON	2240-001	SE-09	16	ID	2.71	19	15
MORTON HOSPITAL							

ID-Uneven distribution of samples within the year prevents accurate calculation of annual arithmetic mean.

BDL-Below detectable limit of the analysis method.

TABLE 16

1977 SO₂ BUBBLER SUMMARYDEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORKSULFUR DIOXIDE (SO₂) method: WEST-GAEKE units: PARTS PER BILLION (ppb)

CITY	SAROAD	DIST	NUMBER	ANNUAL	GEOM	MAXIMUM	2nd
	I.D.	I.D.	OF	ARITH.	STANDARD	24 hr	MAXIMUM
SITE LOCATION			OBS.	MEAN	DEV.	OBS	24 hr
							OBS

BERKSHIRE AIR QUALITY CONTROL REGION (117)

ADAMS	0020-001	BK-07	16	ID	2.34	16	14
SEWAGE TREATMENT PLANT							
LEE	1020-001	BK-06	15	ID	2.13	10	8
SEWAGE TREATMENT PLANT							
NORTH ADAMS	1580-002	BK-08	41	7*	2.71	23	22
HOLDEN STREET							
PITTSFIELD	1800-002	BK-04	43	15*	3.47	70	46
HIBBARD SCHOOL							
PITTSFIELD	1800-004	BK-03	46	7*	2.82	34	24
DALTON AVE., STATE POLICE							

CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)

ATHOL	0100-001	CM-08	44	8*	2.92	43	25
CITY HALL							
FITCHBURG	0620-003	CM-13	43	10*	2.44	25	23
G&E SUBSTA. SUMMER ST.							
FITCHBURG	0620-004	CM-14	42	8*	2.34	25	20
WATER ST. FIRE STATION							
FITCHBURG	0620-006	CM-16	41	BDL	2.45	27	26
GAS & ELECTRIC BUILDING							
WARREN	2372-001	CM-10	43	BDL	2.37	15	14
HIGH SCHOOL							
WORCESTER	2640-004	CM-02	44	11*	3.41	32	28
NARCUS DEPARTMENT STORE							
WORCESTER	2640-008	CM-01	39	6*	2.39	19	18
CLARK UNIVERSITY							
WORCESTER	2640-009	CM-07	46	11*	2.87	44	43
PARKER BUILDING							
WORCESTER	2640-012	CM-11	45	10*	3.35	57	35
WASHINGTON AND NEW SALEM							
WORCESTER	2640-013	CM-15	42	7*	3.15	31	26
HEALTH DEPARTMENT							

(continued)

1977 SO₂ BUBBLER SUMMARY

units: ppb

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH. MEAN	GEOM STANDARD DEV.	MAXIMUM 24 hr OBS	2nd MAXIMUM 24 hr OBS
SITE LOCATION							
<u>METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)</u>							
ASHLAND	0092-001	MB-30	10	ID	2.35	14	4
4 H CENTER, CHESTNUT ST							
BOSTON	0240-002	MB-01	35	14*	2.35	45	33
KENMORE SQUARE							
BOSTON	0240-012	MB-04	33	9*	2.85	26	23
SOUTH BAY							
BOSTON	0240-016	MB-25	15	ID	2.89	31	28
CALLAHAN TUNNEL							
BROCKTON	0320-003	MB-SE	27	ID	1.37	3	2
PAINE SCHOOL, CRESCENT ST							
BROOKLINE	0340-001	MB-17	31	7*	3.10	22	20
HIGH SCHOOL							
CAMBRIDGE	0360-001	MB-11	33	6*	2.84	23	19
HARVARD HERBARIUM							
CAMBRIDGE	0360-004	MB-05	40	12*	2.28	45	26
SCIENCE PARK							
FRAMINGHAM	0660-001	MB-14	37	BDL	2.42	14	11
MIDDLESEX COUNTY COURT							
LYNN	1100-001	MB-06	38	10*	3.19	33	32
CITY HALL							
MEDFIELD	1210-001	MB-28	12	ID	2.20	16	8
STATE HOSPITAL							
MEDFORD	1220-002	MB-08	34	7*	2.94	24	22
FIRE HEADQUARTERS							
MEDFORD	1220-003	MB-19	39	8*	2.28	25	23
WELLINGTON CIRCLE							
NEEDHAM	1480-003	MB-33	32	BDL	1.99	11	11
GLOVER MEMORIAL HOSPITAL							
NORWOOD	1700-001	MB-18	38	BDL	2.34	17	13
NAHATAN STREET FIRE STA							
QUINCY	1880-002	MB-21	39	10*	2.88	49	27
FORE RIVER BRIDGE							
QUINCY	1880-007	MB-31	36	5*	2.93	29	22
ATLANTIC FIRE STATION							
REVERE	1940-002	MB-10	39	11*	2.98	35	35
GARFIELD JUNIOR HIGH							
WALTHAM	2340-004	MB-20	33	8*	3.34	22	21
MAIN & MOODY STREETS							
WOBURN	2620-002	MB-09	35	5*	2.76	34	11
MIDDLESEX COUNTY COURT							

(continued)

TABLE 16 (cont)

1977 SO₂ BUBBLER SUMMARY

units: ppb

CITY SITE LOCATION	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH. MEAN	GEOM STANDARD DEV.	MAXIMUM 24 hr OBS	2nd MAXIMUM 24 hr OBS
<u>MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)</u>							
AYER DISTRICT COURT HOUSE	0140-001	MV-06	11	ID	1.74	24	17
HAVERHILL MUNICIPAL BUILDING	0840-001	MV-02	44	10*	3.39	40	29
LAWRENCE LAWRENCE GENERAL HOSPITAL	1000-003	MV-10	40	15*	3.15	61	42
LOWELL HIGH SCHOOL	1080-001	MV-04	47	10*	2.95	31	29
LOWELL FATHER NORTON MANOR	1080-003	MV-07	44	11*	2.78	40	32
LOWELL JOHN STREET MUNIC. GARAGE	1080-004	MV-09	41	9*	3.24	29	29
NEWBURYPORT SULLIVAN BUILDING	1520-002	MV-08	10	ID	1.95	23	21
<u>PIONEER VALLEY AIR QUALITY CONTROL REGION (042)</u>							
CHICOPEE CITY HALL	0400-001	PV-03	43	11*	2.96	35	30
CHICOPEE MEADOW STREET	0400-003	PV-07	14	ID	3.13	28	19
CHICOPEE CHICOPEE STREET	0400-005	PV-14	42	9*	3.10	37	19
GREENFIELD WATER TREATMENT PLANT	0780-002	PV-13	13	ID	2.60	17	16
HOLYOKE MAIN STREET FIRE STATION	0860-002	PV-18	5	ID	2.05	4	4
HOLYOKE CANAL STREET	0860-004	PV-04	23	ID	3.15	37	36
HOLYOKE BEAUDRY BONCHER APTS.	0860-006	PV-19	14	ID	1.59	28	26
SPRINGFIELD MILL STREET	2160-002	PV-02	42	13*	2.69	34	34
SPRINGFIELD TAYLOR STREET FIRE STATION	2160-003	PV-01	39	10*	2.64	33	33
SPRINGFIELD EAST COLUMBUS AVENUE	2160-005	PV-06	44	12*	2.27	36	28
(continued)							

TABLE 16 (cont)

1977 SO₂ BUBBLER SUMMARY

units: ppb

CITY SITE LOCATION	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH. MEAN	GEOM STANDARD DEV.	MAXIMUM 24 hr OBS	2nd MAXIMUM 24 hr OBS
<u>SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)</u>							
ATTLEBORO SOUTH MAIN ST. FIRE STATION	0120-002	SE-05	46	10*	2.41	31	26
FALL RIVER CENTRAL FIRE STATION	0580-001	SE-04	44	10*	2.63	41	26
FALL RIVER GLOBE STREET TRAILER	0580-004	SE-06	44	BDL	2.43	15	12
NEW BEDFORD HIGH SCHOOL	1500-002	SE-03	43	BDL	1.79	13	6
PLYMOUTH FIRE STATION	1820-001	SE-01	7	ID	1.87	10	9
TAUNTON MORTON HOSPITAL	2240-001	SE-09	41	5*	2.63	17	12

ID - Insufficient data in two or more quarters prevents accurate calculation of annual arithmetic mean.

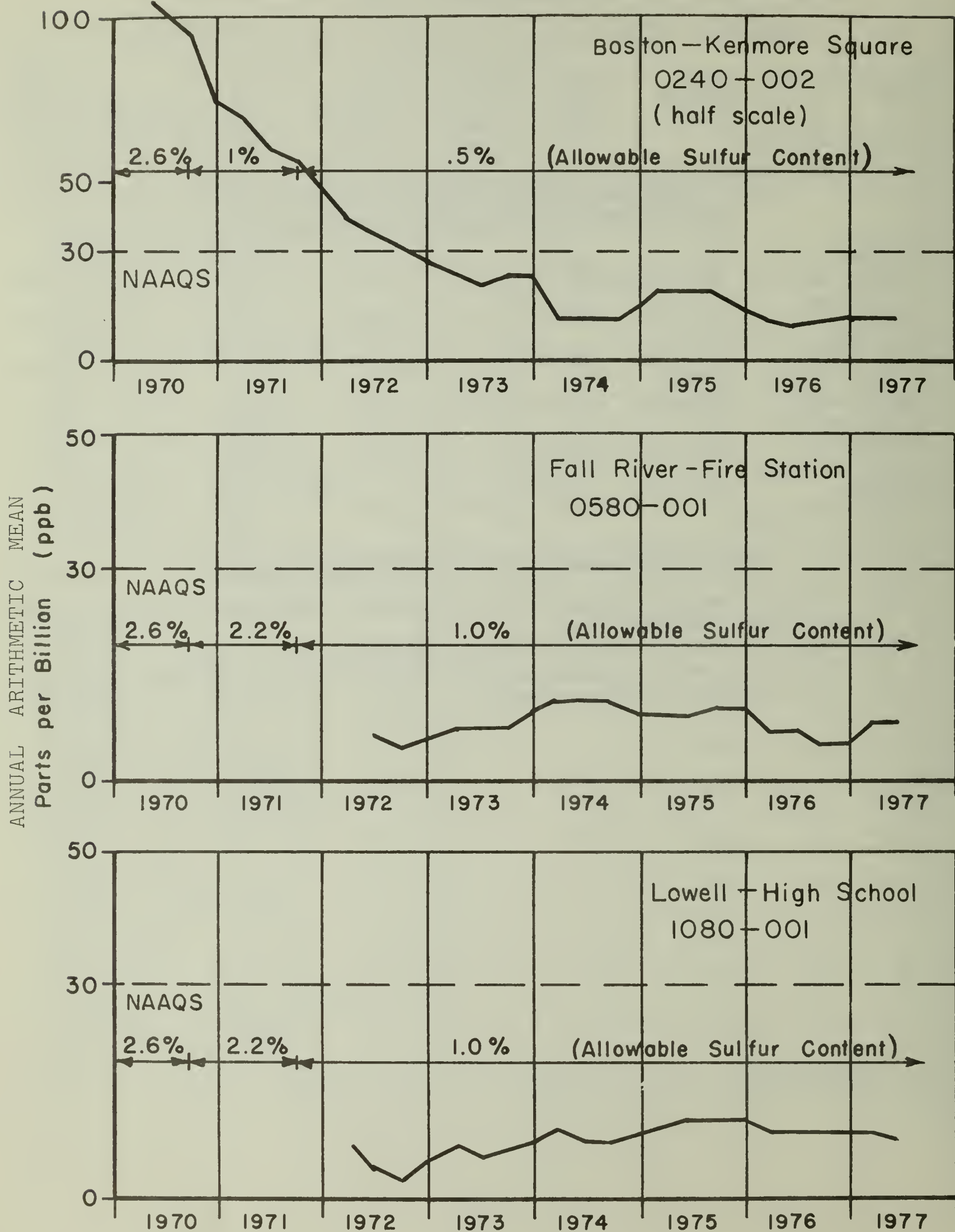
BDL - Below detectable limit of analysis technique (i.e. 5 ppb).

* - Arithmetic mean calculated without summer quarter data and, therefore, it is probably an over-estimate.

Annual Arithmetic Means - Running Averages

SULFUR DIOXIDE (SO₂)

Massachusetts Air Surveillance Network (MASN)



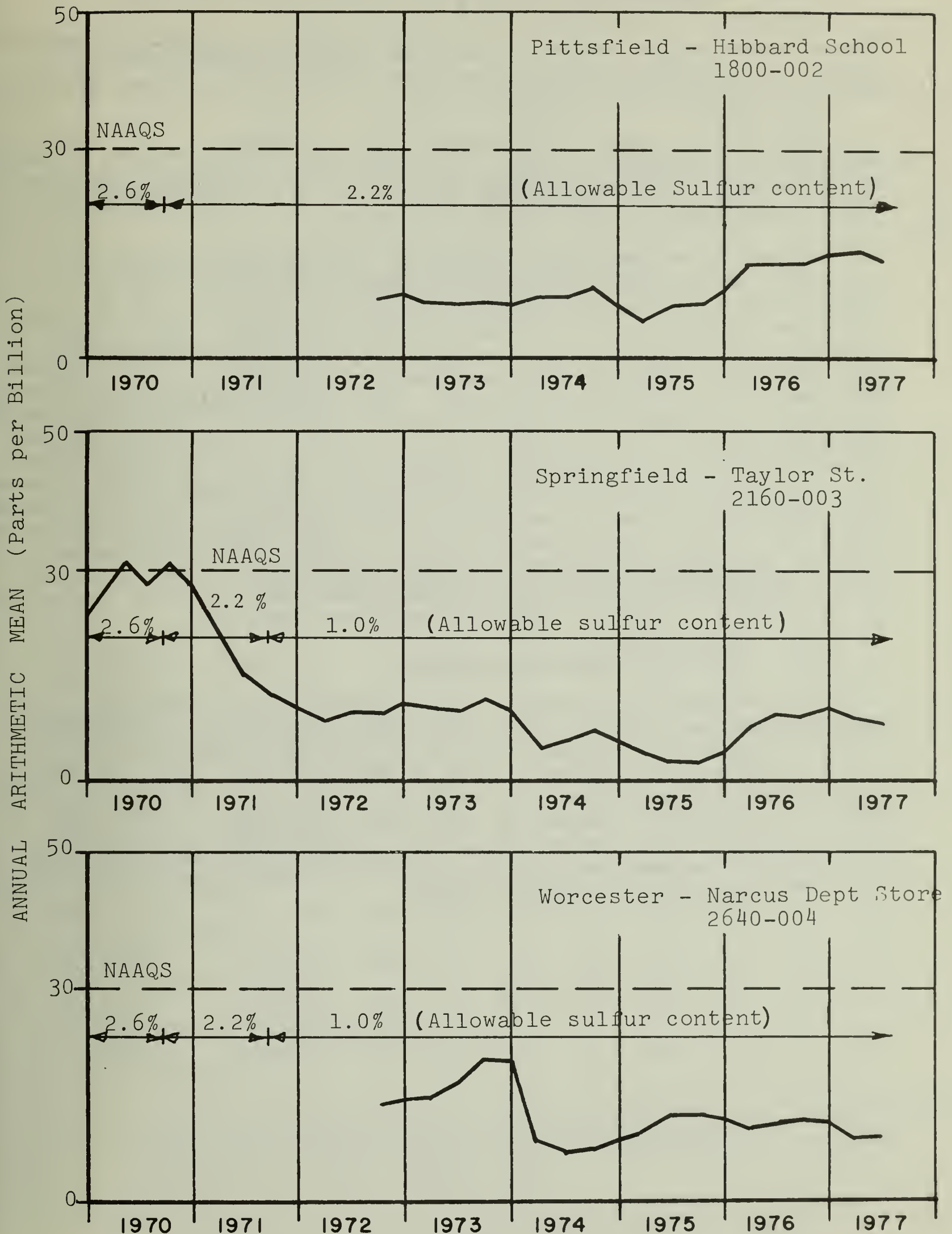
NAAQS - National Ambient Air Quality Standard

FIGURE 12B

SULFUR DIOXIDE (SO₂)

Annual Arithmetic Means - Running Averages

Massachusetts Air Surveillance Network (MASN)



NAAQS - National Ambient Air Quality Standard

7.2 Total Suspended Particulates (TSP)

7.2.1 Conclusions

Violations of the Primary TSP standard occurred in the Central Massachusetts Pioneer Valley Regions in 1976. Violations to the secondary TSP standard occurred in Berkshire, Central Massachusetts, Metropolitan Boston, Merrimack Valley and Pioneer Valley Regions in 1976.

For 1977, violations of the primary TSP standard were measured in Central Massachusetts, Metropolitan Boston and Pioneer Valley Regions. Violations of the secondary TSP standards were observed in the Central Massachusetts, Pioneer Valley Regions, and Metropolitan Boston.

Because of the number and frequency of the continued violation to the primary and secondary TSP standards, DAHM has contracted with the Massachusetts Science and Technology Foundation to conduct a year long study of TSP concentrations in Boston, Springfield, Fall River. EPA will be conducting a similar survey in Worcester. The purpose of these surveys will be to determine, through physical and chemical testing of the collected aerosol, the cause of these continued violations. DAHM believes that many sites within its network may be unduly influenced by re-entrained road dirt and such non-traditional sources of particulates as road sanding and salting operations. An ancillary part of these studies, however, will provide much needed information as to particle size distribution and hence health significance of urban aerosols. It is believed that these surveys (which are being conducted with the financial assistance of several Massachusetts industries) will provide much needed technical data which will be used to develop meaningful and cost effective control strategies for particulate emission regulations. Table 17 and 18 contain the TSP summaries. Figure 13 shows the seven year TSP trends.

7.2.2 Sample Collection and Analysis

TSP measurements are routinely made using the standard high volume air sampler method every sixth day. In this procedure air is drawn through an 8" x 10" fiberglass pre-weighed filter at the rate of 60 CFM for a period of 24 hours beginning at midnight. At the conclusion of the sampling, the filter is removed and transported to a laboratory for reweighing. The difference in weights in milligrams is divided by the volume of air passed through thus giving a weight per unit volume result i.e., ug/M^3 . Upon completion of the TSP (weight/unit volume) calculation several other physical and chemical tests can be performed upon the collected sample.

TABLE 17

1976 TSP SUMMARY

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORKTOTAL SUSPENDED PARTICULATES method: HIGH-VOLUME FILTER units: $\mu\text{gm}/\text{M}^3$

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBSERVATIONS	ANNUAL GEOM MEAN	GEOMETRIC STD. DEV.	MAXIMUM 24hr OBSERVATION	2nd MAX 24hr OBSERVATION	# OF OBS ABOVE 260	# of OBS ABOVE 150
SITE LOCATION									
<u>BERKSHIRE AIR QUALITY CONTROL REGION</u>									
ADAMS	0020-001	BK-07	51	61	1.55	133	124	0	0
SEWAGE TREATMENT PLANT									
LEE	1020-001	BK-06	55	31	1.54	88	72	0	0
SEWAGE TREATMENT PLANT									
NORTH ADAMS	1580-002	BK-08	56	49	1.68	162	130	0	1
HOLDEN STREET									
PITTSFIELD	1800-002	BK-04	58	41	1.67	121	110	0	0
HIBBARD SCHOOL									
PITTSFIELD	1800-004	BK-03	146	46	1.65	162	158	0	2
DALTON AVE. STATE POLICE									
<u>CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION</u>									
ATHOL	0100-001	CM-08	55	43	1.68	145	140	0	0
CITY HALL									
FITCHBURG	0620-004	CM-14	127	49	1.64	252	165	0	3
WATER STREET FIRE STATION									
FITCHBURG	0620-006	CM-16	46	ID	1.52	131	102	0	0
GAS AND ELECTRIC BUILDING									
WARREN	2372-001	CM-10	59	31	1.77	118	97	0	0
HIGH SCHOOL									
WORCESTER	2640-004	CM-02	257	61	1.74	300	275	2	19
NARCUS DEPARTMENT STORE									
WORCESTER	2640-008	CM-01	117	49	1.67	151	140	0	1
CLARK UNIVERSITY									
WORCESTER	2640-009	CM-07	114	50	1.53	176	174	0	3
PARKER BUILDING									
WORCESTER	2640-011	CM-05	52	50	1.69	176	165	0	3
QUINSIGAMOND COLLEGE									
WORCESTER	2640-012	CM-11	280	94	1.83	485	472	13	51
WASHINGTON AND NEW SALEM STS.									
WORCESTER	2640-013	CM-15	117	55	1.83	272	246	1	9
HEALTH DEPARTMENT									

(continued)

ID - UNEVEN DISTRIBUTION OF SAMPLES WITHIN THE YEAR PREVENTS ACCURATE
CALCULATION OF ANNUAL GEOMETRIC MEAN

TABLE 17 (cont)

1976 TSP SUMMARY			units: $\mu\text{gm}/\text{M}^3$						
CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBSERVATIONS	ANNUAL GEOM. MEAN	GEOMETRIC STD. DEV.	MAXIMUM 24hr OBSERVATION	2nd MAX 24hr OBSERVATION	# OF OBS. ABOVE 260	# OF OBS. ABOVE 150
SITE LOCATION									
METROPOLITAN BOSTON AIR QUALITY CONTROL REGION									
BOSTON	0240-001	MB-02	46	57	1.46	149	117	0	0
JFK FEDERAL BUILDING									
BOSTON	0240-002	MB-01	57	94	1.52	264	256	1	8
KENMORE SQUARE									
BOSTON	0240-012	MB-04	24	ID	1.50	112	103	0	0
SOUTH BAY									
BROOKLINE	0340-001	MB-17	49	35	1.64	113	82	0	0
HIGH SCHOOL									
CAMBRIDGE	0360-001	MB-11	48	45	1.55	146	101	0	0
HARVARD HERBARIUM									
CAMBRIDGE	0360-004	MB-05	15	ID	1.49	101	77	0	0
SCIENCE PARK									
FRAMINGHAM	0660-001	MB-14	49	38	1.63	137	101	0	0
MIDDLESEX COUNTY COURT									
LYNN	1100-001	MB-06	45	47	1.59	141	115	0	0
CITY HALL									
MARBLEHEAD	1160-001	MB-07	49	41	1.61	119	113	0	0
JUNIOR HIGH SCHOOL									
MAYNARD	1200-001	MB-13	31	ID	1.70	72	60	0	0
ARMY METEOROLOGICAL TEAM									
MEDFORD	1220-002	MB-08	52	52	1.54	158	142	0	1
FIRE HEADQUARTERS									
MEDFORD	1220-003	MB-19	51	76	1.53	283	164	1	3
WELLINGTON CIRCLE									
NEEDHAM	1480-003	MB-33	42	37	1.67	166	125	0	1
GLOVER MEMORIAL HOSPITAL									
NORWOOD	1700-001	MB-18	46	46	1.53	142	108	0	0
NAHATAN ST. FIRE STATION									
QUINCY	1880-002	MB-21	46	58	1.46	179	116	0	1
FORE RIVER BRIDGE									
QUINCY	1880-007	MB-31	8	ID	1.40	58	51	0	0
ATLANTIC FIRE STATION									
REVERE	1940-002	MB-10	49	47	1.59	147	134	0	0
GARFIELD JUNIOR HIGH									
WALTHAM	2340-003	MB-12	39	ID	1.73	100	97	0	0
U. MASS. FIELD STATION									
WALTHAM	2340-004	MB-20	45	67	1.48	174	129	0	1
MAIN AND MOODY STREETS									
WOBURN	2620-002	MB-09	27	ID	1.50	129	100	0	0
MIDDLESEX COUNTY COURT									

(continued)

ID - UNEVEN DISTRIBUTION OF SAMPLES WITHIN THE YEAR PREVENTS ACCURATE
CALCULATION OF ANNUAL GEOMETRIC MEAN

1976 TSP SUMMARY

units: $\mu\text{gm}/\text{M}^3$

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBSERVATIONS	ANNUAL GEOM MEAN	GEOMETRIC STD. DEV.	MAXIMUM 24hr OBSERVATION	2nd MAX 24hr OBSERVATION	# OF OBS. ABOVE 260	# OF OBS. ABOVE 150
SITE LOCATION									
MERRIMACK VALLEY AIR QUALITY CONTROL REGION									
AYER	0140-001	MV-06	55	40	1.62	155	104	0	1
DISTRICT COURT HOUSE									
HAVERHILL	0840-001	MV-02	46	48	1.65	134	120	0	0
MUNICIPAL BUILDING									
LAWRENCE	1000-003	MV-10	126	54	1.63	189	166	0	3
LAWRENCE GENERAL HOSPITAL									
LOWELL	1080-001	MV-04	55	48	1.51	114	104	0	0
HIGH SCHOOL									
LOWELL	1080-003	MV-07	41	47	1.50	101	100	0	0
FATHER NORTON MANOR									
NEWBURYPORT	1520-002	MV-08	42	ID	1.62	115	80	0	0
SULLIVAN BUILDING									
PIONEER VALLEY AIR QUALITY CONTROL REGION									
CHICOPEE	0400-001	PV-03	59	48	1.66	137	121	0	0
CITY HALL									
CHICOPEE	0400-003	PV-07	58	41	1.72	135	117	0	0
MEADOW STREET									
GREENFIELD	0780-002	PV-13	55	28	2.05	104	90	0	0
WATER TREATMENT PLANT									
HOLYOKE	0860-004	PV-04	58	52	1.61	139	128	0	0
CANAL STREET									
NORTHFIELD	1652-001	PV-08	20	ID	1.85	154	83	0	1
NORTHFIELD SCHOOL									
SPRINGFIELD	2160-002	PV-02	56	51	1.58	150	149	0	0
MILL STREET									
SPRINGFIELD	2160-003	PV-01	151	60	1.60	184	181	0	5
TAYLOR STREET FIRE STATION									
SPRINGFIELD	2160-005	PV-06	56	119	1.63	399	331	4	17
EAST COLUMBUS AVENUE									
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION									
ATTLEBORO	0120-002	SE-05	50	ID	1.51	130	84	0	0
SOUTH MAIN ST FIRE STATION									
FALL RIVER	0580-001	SE-04	55	48	1.44	99	90	0	0
CENTRAL FIRE STATION									
FALL RIVER	0580-004	SE-06	47	ID	1.45	136	110	0	0
GLOBE STREET TRAILER									

(continued)

ID - UNEVEN DISTRIBUTION OF SAMPLES WITHIN THE YEAR PREVENTS ACCURATE
CALCULATION OF ANNUAL GEOMETRIC MEAN

TABLE 17 (cont)

1976 TSP SUMMARYunits: $\mu\text{gm}/\text{M}^3$

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBSERVATIONS	ANNUAL GEOM MEAN	GEOMETRIC STD. DEV.	MAXIMUM 24hr OBSERVATION	2nd MAX 24hr OBSERVATION	# OF OBS. ABOVE 260	# OF OBS. ABOVE 150
SITE LOCATION									
<u>SOUTHEASTERN MASSACHUSETTS AQCR (continued)</u>									
FALMOUTH	0600-001	SE-02	36	ID	1.40	71	60	0	0
FIRE STATION									
NEW BEDFORD	1500-002	SE-03	48	37	1.53	105	94	0	0
HIGH SCHOOL									
PLYMOUTH	1820-001	SE-01	49	ID	1.64	131	128	0	0
FIRE STATION									
TAUNTON	2240-001	SE-09	17	ID	1.51	69	59	0	0
MORTON HOSPITAL									

ID - UNEVEN DISTRIBUTION OF SAMPLES WITHIN THE YEAR PREVENTS ACCURATE
CALCULATION OF ANNUAL GEOMETRIC MEAN

1977 TSP SUMMARYDEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORKTOTAL SUSPENDED PARTICULATES (TSP) method: HI-VOL units: $\mu\text{gm}/\text{M}^3$

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBSERVATIONS	ANNUAL GEOM MEAN	GEOMETRIC STD. DEV.	MAXIMUM 24hr OBSERVATION	2nd MAX 24hr OBSERVATION	# OF OBS ABOVE 260	# OF OBS ABOVE 150
SITE LOCATION									
BERKSHIRE AIR QUALITY CONTROL REGION (117)									
ADAMS	0020-001	BK-07	14	ID	1.62	178	102	0	1
SEWAGE TREATMENT PLANT									
LEE	1020-001	BK-06	13	ID	1.44	42	33	0	0
SEWAGE TREATMENT PLANT									
PITTSFIELD	1800-002	BK-04	52	43	1.67	206	113	0	1
HIBBARD SCHOOL									
PITTSFIELD	1800-004	BK-03	56	47	1.75	150	137	0	0
DALTON AVE., STATE POLICE									
NORTH ADAMS	1580-002	BK-08	23	ID	1.84	197	143	0	1
HOLDEN STREET									
CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)									
ATHOL	0100-001	CM-08	52	44	1.57	125	124	0	0
CITY HALL									
FITCHBURG	0620-004	CM-14	56	46	1.54	124	105	0	0
WATER STREET FIRE STATION									
FITCHBURG	0620-006	CM-16	52	46	1.53	136	90	0	0
GAS & ELECTRIC BUILDING									
WARREN	2372-001	CM-10	54	30	1.71	104	95	0	0
HIGH SCHOOL									
WORCESTER	2640-004	CM-02	254	54	1.70	323	225	1	10
NARCUS DEPARTMENT STORE									
WORCESTER	2640-008	CM-07	52	44	1.60	206	133	0	1
CLARK UNIVERSITY									
WORCESTER	2640-009	CM-01	56	43	1.60	171	122	0	1
PARKER BUILDING									
WORCESTER	2640-011	CM-05	52	41	1.73	192	140	0	1
QUINSIGAMOND COLLEGE									
WORCESTER	2640-011	CM-11	248	89	1.99	1091*	647	25	44
WASHINGTON & NEW SALEM STS									
WORCESTER	2640-013	CM-15	49	51	1.71	298	175	1	3
HEALTH DEPARTMENT									

(continued)

* High day due to effect of street sweeper on the TSP filter

ID - Uneven distribution of samples within the year prevents accurate
determination of the annual geometric mean

TABLE 18 (cont)

1977 TSP SUMMARYunits: $\mu\text{gm}/\text{M}^3$

CITY SITE LOCATION	SAROAD I.D.	DIST I.D.	NUMBER OF OBSERVATIONS	ANNUAL GEOM. MEAN	GEOMETRIC STD. DEV.	MAXIMUM 24 hr OBSERVATION	2nd MAX 24 hr OBSERVATION	# OF OBS. ABOVE 260	# OF OBS. ABOVE 150
<u>MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)</u>									
AYER DISTRICT COURT HOUSE	0140-001	MV-06	12	ID	1.57	65	53	0	0
HAVERHILL MUNICIPAL BUILDING	0840-001	MV-02	54	40	1.48	95	86	0	0
LAWRENCE LAWRENCE GENERAL HOSPITAL	1000-003	MV-10	57	48	1.51	127	124	0	0
LOWELL HIGH SCHOOL	1080-001	MV-04	56	46	1.65	135	135	0	0
LOWELL FATHER NORTON MANOR	1080-003	MV-07	56	52	1.52	119	115	0	0
NEWBURYPORT SULLIVAN BUILDING	1520-002	MV-08	8	ID	1.26	44	43	0	0
<u>METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)</u>									
ASHLAND 4 H CNTR, CHESTNUT ST	0092-001	MB-30	10	ID	1.87	100	61	0	0
BOSTON KENMORE SQUARE	0240-002	MB-01	43	79	1.70	305	270	2	7
BOSTON SOUTH BAY	0240-012	MB-04	54	56	1.47	121	102	0	0
BROCKTON PAINE SCH., CRESCENT ST.	0320-003	MB-SE	42	ID	1.54	107	66	0	0
BROOKLINE HIGH SCHOOL	0340-001	MB-17	44	37	1.42	76	73	0	0
CAMBRIDGE HARVARD HERBARIUM	0360-001	MB-11	36	ID	1.50	145	120	0	0
CAMBRIDGE SCIENCE PARK	0360-004	MB-05	49	66	1.36	116	115	0	0
CHELSEA FIRE HEADQUARTERS	0380-002	MB-32	16	ID	1.52	136	131	0	0
FRAMINGHAM MIDDLESEX COUNTY COURT	0660-001	MB-14	52	40	1.45	97	72	0	0
LYNN CITY HALL	1100-001	MB-06	46	47	1.45	97	89	0	0
MEDFIELD STATE HOSPITAL	1210-001	MB-28	21	ID	1.42	55	50	0	0
(continued)									

ID - Uneven distribution of samples within the year prevents accurate calculation of the annual geometric mean

TABLE 18 (cont)

1977 TSP SUMMARYunits: $\mu\text{gm}/\text{M}^3$

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBSERVATIONS	ANNUAL GEOM. MEAN	GEOMETRIC STD. DEV.	MAXIMUM 24 hr OBSERVATION	2nd MAX 24 hr OBSERVATION	# OF OBS. ABOVE 260	# OF OBS. ABOVE 150
SITE LOCATION									
<u>METROPOLITAN BOSTON AQCR (119) (continued)</u>									
MEDFORD	1220-002	MB-08	53	54	1.53	145	131	0	0
FIRE HEADQUARTERS									
MEDFORD	1220-003	MB-19	40	ID	1.42	161	111	0	1
WELLINGTON CIRCLE									
NEEDHAM	1480-003	MB-33	33	ID	2.07	103	65	0	0
GLOVER MEMORIAL HOSPITAL									
NORWOOD	1700-001	MB-18	52	42	1.54	123	109	0	0
NAHATAN ST. FIRE STATION									
QUINCY	1880-002	MB-21	49	60	1.52	119	114	0	0
FORE RIVER BRIDGE									
QUINCY	1880-007	MB-31	45	42	1.57	110	87	0	0
ATLANTIC FIRE STATION									
REVERE	1940-002	MB-10	49	47	1.50	107	101	0	0
GARFIELD JR HIGH SCHOOL									
WALTHAM	2340-004	MB-20	42	69	1.53	186	170	0	3
MAIN AND MOODY STREETS									
WOBURN	2620-002	MB-09	43	44	1.66	260	145	0	1
MIDDLESEX COUNTY COURT									
<u>PIONEER VALLEY AIR QUALITY CONTROL REGION (042)</u>									
CHICOPEE	0400-001	PV-03	54	49	1.55	178	131	0	1
CITY HALL									
CHICOPEE	0400-003	PV-07	15	ID	1.41	99	54	0	0
MEADOW STREET									
GREENFIELD	0780-002	PV-13	15	ID	1.65	64	53	0	0
WATER TREATMENT PLANT									
HOLYOKE	0860-002	PV-18	15	ID	1.30	85	79	0	0
MAIN ST. FIRE STATION									
HOLYOKE	0860-004	PV-04	24	ID	1.60	114	103	0	0
CANAL STREET									
HOLYOKE	0860-006	PV-19	47	ID	1.50	108	95	0	0
BEAUDRY BONCHER APTS									
NORTHFIELD	1652-001	PV-08	44	27	1.76	72	71	0	0
NORTHFIELD SCHOOL									
SPRINGFIELD	2160-002	PV-02	57	55	1.58	187	129	0	1
MILL STREET									
SPRINGFIELD	2160-003	PV-01	51	60	1.47	154	126	0	1
TAYLOR ST. FIRE STATION									
SPRINGFIELD	2160-005	PV-06	45	121	1.59	362	320	5	11
EAST COLUMBUS AVENUE									

(continued)

ID - Uneven distribution of samples prevents accurate calculation of G. mean

TABLE 18 (cont)

1977 TSP SUMMARYunits: $\mu\text{gm}/\text{M}^3$

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBSERVATIONS	ANNUAL GEOM. MEAN	GEOMETRIC STD. DEV.	MAXIMUM 24 hr OBSERVATION	2nd MAX 24 hr OBSERVATION	# OF OBS. ABOVE 260	# OF OBS. ABOVE 150
SITE LOCATION									
SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)									
ATTLEBORO	0120-002	SE-05	57	42	1.46	102	89	0	0
SOUTH MAIN ST. FIRE STATION									
FALL RIVER	0580-001	SE-04	58	55	1.44	147	126	0	0
CENTRAL FIRE STATION									
FALL RIVER	0580-004	SE-06	7	ID	1.67	112	68	0	0
GLOBE STREET TRAILER									
NEW BEDFORD	1500-002	SE-03	55	34	1.42	85	58	0	0
HIGH SCHOOL									
PLYMOUTH	1820-001	SE-01	6	ID	1.59	88	36	0	0
FIRE STATION									
TAUNTON	2240-001	SE-09	52	42	1.56	120	94	0	0
MORTON HOSPITAL									

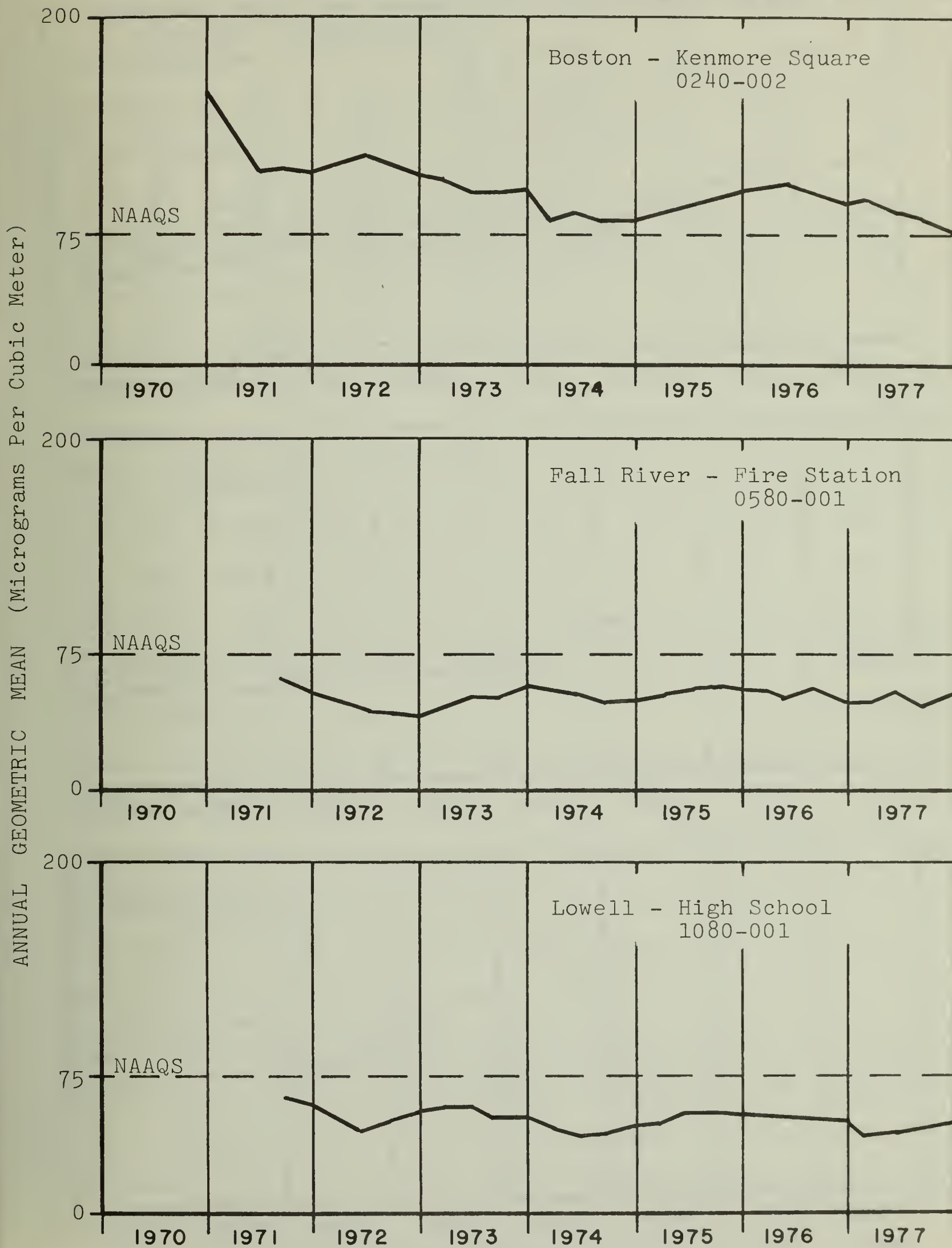
ID - Uneven distribution of samples prevents accurate calculation of annual geometric mean

FIGURE 13A

TOTAL SUSPENDED PARTICULATES (TSP)

ANNUAL GEOMETRIC MEANS - RUNNING AVERAGES

Massachusetts Air Surveillance Network (MASN)



NAAQS - National Ambient Air Quality Standard

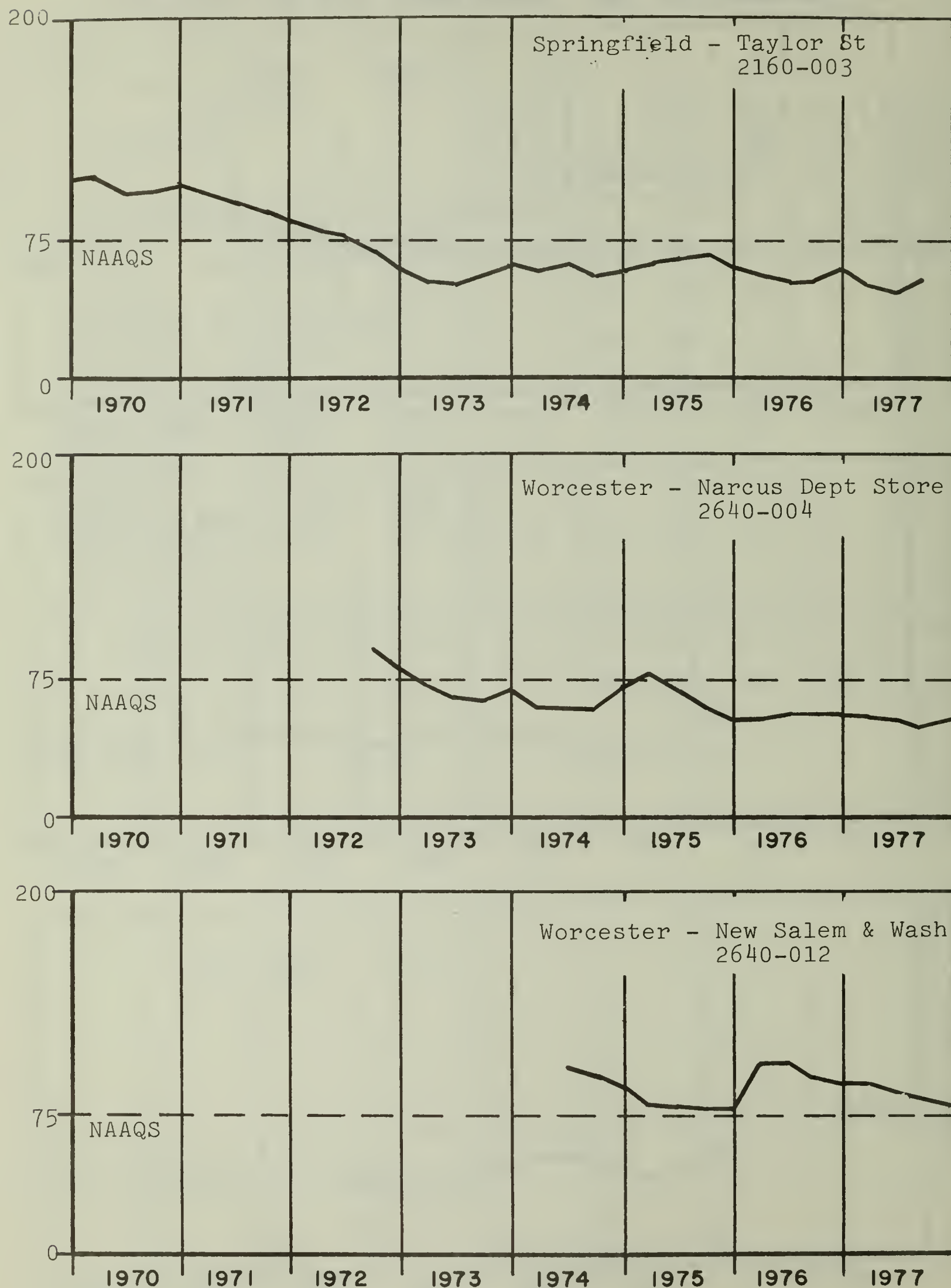
FIGURE 13B

TOTAL SUSPENDED PARTICULATES (TSP)

Annual Geometric Means - Running Averages

Massachusetts Air Surveillance Network (MASN)

ANNUAL GEOMETRIC MEAN (Micrograms Per Cubic Meter)



NAAQS - National Ambient Air Quality Standard

7.3 Nitrogen Dioxide (NO₂)

7.3.1 Conclusions

The following data as presented for years 1976-1977 show all of the regions of the state to be attaining the National Ambient Air Quality Standard for NO₂ on the basis of non-continuous (bubbler) data. Tables 19 and 20 contain the NO₂ summaries. Figure 14 shows the NO₂ trends for 5 years.

7.3.2 Sample Collection and Analysis

NO₂ bubbler samples were collected in a similar fashion as described for non-continuous SO₂ viz a gas impingement every sixth day train followed by colorimetric analysis in a central laboratory. In this case, the chemical absorption materials are specific for NO₂ and the subsequent color intensity produced being proportional to amount of NO₂ absorbed. The specific test procedure used, Sodium Arsenite Procedure, is an equivalent method as required by Part 53, 40 CFR February 18, 1975. However, as the following tables note there was a substantial reduction in the number of NO₂ measurement sites from 1976 to 1977. The reasons for this reduction were uncertainties with the specific test procedure used and the need to optimize monitoring resources, both personnel and equipment. The test limitations encountered dealt with an unknown positive interference which was noted when this method was used near areas subject to large volumes of automotive emissions. The exact cause and extent of this interference have not yet been documented. Moreover, EPA has recommended that this measurement method not be used in areas subject to heavy traffic volumes. Consequently, DAHM chose to reduce the number of measurement sites based upon the number of years of data compliance showing with the NO₂ National Ambient Air Quality Standard at almost all of its measurement sites and to retain only those sites located close to roadways where continuous NO₂ data could be compared to bubbler data for research purposes.

TABLE 19

1976 NO₂ BUBBLER SUMMARYDEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORKNITROGEN DIOXIDE (NO₂) method: SODIUM ARSINITE units: PARTS PER BILLION (ppb)

CITY SITE LOCATION	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH. MEAN	GEOM STANDARD DEV.	MAXIMUM 24 hr OBS	2nd MAXIMUM 24 hr OBS
<u>BERKSHIRE AIR QUALITY CONTROL REGION (117)</u>							
ADAMS SEWAGE TREATMENT PLANT	0020-001	BK-07	56	17	1.64	41	39
LEE SEWAGE TREATMENT	1020-001	BK-06	60	14	1.55	32	29
NORTH ADAMS HOLDEN STREET	1580-002	BK-08	58	17	1.65	38	36
PITTSFIELD HIBBARD SCHOOL	1800-002	BK-04	61	21	1.58	49	43
PITTSFIELD DALTON AVE., STATE POLICE	1800-004	BK-03	61	25	1.56	60	47
<u>CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)</u>							
ATHOL CITY HALL	0100-001	CM-08	59	18	1.62	58	51
FITCHBURG CITY HALL	0620-002	CM-12	19	27	1.64	64	49
FITCHBURG G&E SUB STA, SUMMER ST.	0620-003	CM-13	59	24	1.54	89	71
FITCHBURG WATER ST. FIRE STATION	0620-004	CM-14	54	26	1.50	59	55
FITCHBURG GAS AND ELECTRIC BUILDING	0620-006	CM-16	39	ID	1.78	38	37
WARREN HIGH SCHOOL	2372-001	CM-10	59	18	2.11	51	46
WORCESTER NARCUS DEPARTMENT STORE	2640-004	CM-02	57	38	1.40	83	77
WORCESTER CLARK UNIVERSITY	2640-008	CM-01	60	25	1.57	66	49
WORCESTER PARKER BUILDING	2640-009	CM-07	57	27	1.57	67	66
WORCESTER WASHINGTON & NEW SALEM STS	2640-012	CM-11	61	36	1.41	79	75
WORCESTER HEALTH DEPARTMENT	2640-013	CM-15	60	32	1.52	63	62

(continued)

ID -Uneven distribution of samples within the year prevents accurate calculation
of annual arithmetic mean

1976 NO₂ BUBBLER SUMMARY

units: ppb

CITY	SAROAD	DIST	NUMBER	ANNUAL	GEOM	MAXIMUM	2nd
SITE LOCATION	I.D.	I.D.	OF	ARITH.	STANDARD	24 Hr	MAX
			OBS.	MEAN	DEV.	OBS	24hr
							OBS

METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)

BOSTON	0240-001	MB-02	42	30	1.82	85	55
JFK FEDERAL BUILDING							
BOSTON	0240-002	MB-01	55	43	1.98	111	63
KENMORE SQUARE							
BOSTON	0240-012	MB-04	20	ID	1.35	69	51
SOUTH BAY							
BROOKLINE	0340-001	MB-17	53	24	1.75	62	60
HIGH SCHOOL							
CAMBRIDGE	0360-001	MB-11	50	26	1.37	55	50
HARVARD HERBARIUM							
CAMBRIDGE	0360-004	MB-05	16	ID	1.41	56	46
SCIENCE PARK							
FRAMINGHAM	0660-001	MB-14	49	19	1.80	48	42
MIDDLESEX COUNTY COURT							
LYNN	1100-001	MB-06	44	25	1.88	49	44
CITY HALL							
MARBLEHEAD	1160-001	MB-07	47	21	1.54	44	40
JUNIOR HIGH SCHOOL							
MAYNARD	1200-001	MB-13	37	9	2.09	24	20
ARMY METEOROLOGICAL TEAM							
MEDFORD	1220-002	MB-08	51	30	1.49	61	60
FIRE HEADQUARTERS							
MEDFORD	1220-003	MB-19	54	37	1.66	71	64
WELLINGTON CIRCLE							
NEEDHAM	1480-003	MB-33	44	19	1.57	34	33
GLOVER MEMORIAL HOSPITAL							
NORWOOD	1700-001	MB-18	49	22	1.78	44	38
NAHATAN FIRE STATION							
QUINCY	1880-002	MB-21	49	29	1.39	64	51
FORE RIVER BRIDGE							
QUINCY	1880-007	MB-31	9	ID	1.76	37	35
ATLANTIC FIRE STATION							
REVERE	1940-002	MB-10	50	29	1.48	73	53
GARFIELD JR. HIGH SCHOOL							
WALTHAM	2340-003	MB-12	42	21	1.81	44	42
U. MASS FIELD STATION							
WALTHAM	2340-004	MB-20	51	32	1.67	60	59
MOODY & MAIN STREETS							
WOBURN	2620-002	MB-09	23	ID	1.70	59	45
MIDDLESEX CNTY COURT							

(continued)

ID - Uneven distribution of samples within the year prevents accurate calculation of annual arithmetic mean.

1976 NO₂ BUBBLER SUMMARY

units: ppb

CITY SITE LOCATION	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH MEAN	GEOM STANDARD DEV.	MAXIMUM 24 Hr OBS	2nd MAX. 24hr OBS
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MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)

AYER DISTRICT COURT HOUSE	0140-001	MV-06	59	18	1.78	49	37
HAVERHILL MUNICIPAL BUILDING	0840-001	MV-02	55	25	1.55	55	44
LAWRENCE LAWRENCE GENERAL HOSPITAL	1000-003	MV-10	51	25	1.55	53	53
LOWELL HIGH SCHOOL	1080-001	MV-04	57	24	1.58	60	46
LOWELL FATHER NORTON MANOR	1080-003	MV-07	54	24	1.63	60	46
LOWELL JOHN ST. MUNICIPAL GARAGE	1080-004	MV-09	57	31	1.46	60	58
NEWBURYPORT SULLIVAN BUILDING	1520-002	MV-08	56	17	1.71	35	32

PIONEER VALLEY AIR QUALITY CONTROL REGION (042)

CHICOPEE CITY HALL	0400-001	PV-03	61	32	1.59	79	71
CHICOPEE MEADOW STREET	0400-003	PV-07	61	29	1.73	78	71
CHICOPEE CHICOPEE STREET	0400-005	PV-14	55	29	1.43	61	55
GREENFIELD WATER TREATMENT PLANT	0780-002	PV-13	59	23	1.72	65	61
HOLYOKE CANAL STREET	0860-004	PV-04	61	31	1.56	87	70
SPRINGFIELD MILL STREET	2160-002	PV-02	60	39	1.56	102	75
SPRINGFIELD TAYLOR ST. FIRE STATION	2160-003	PV-01	57	36	1.45	93	64
SPRINGFIELD EAST COLUMBUS AVENUE	2160-005	PV-06	60	57	1.40	102	99

SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)

ATTLEBORO SO. MAIN ST. FIRE STATION	0120-002	SE-05	55	22	1.51	62	41
FALL RIVER CENTRAL FIRE STATION	0580-001	SE-04	45	21	1.77	40	38
FALL RIVER GLOBE STREET TRAILER	0580-004	SE-06	53	16	1.37	34	28

(continued)

I.D. - Uneven distribution of samples within the year prevents accurate calculations of annual arithmetic mean

TABLE 19 (cont)

1976 NO₂ BUBBLER SUMMARY

units: ppb

CITY SITE LOCATION	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH MEAN	GEOM STANDARD DEV.	MAXIMUM 24 Hr OBS	2nd MAX OBS
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SOUTHEASTERN MASSACHUSETTS AQCR (cont'd)

FALMOUTH FIRE STATION	0600-001	SE-02	36	ID	1.30	26	22
NEW BEDFORD HIGH SCHOOL	1500-002	SE-03	54	14	1.52	32	25
PLYMOUTH FIRE STATION	1820-001	SE-01	53	14	1.45	35	26
TAUNTON MORTON HOSPITAL	2240-001	SE-09	10	ID	1.55	34	25

I.D. - Uneven distribution of samples within the year prevents accurate calculation of annual arithmetic mean

TABLE 20

1977 NO₂ BUBBLER SUMMARYDEPARTMENT OF ENVIRONMENT QUALITY ENGINEERING
MASSACHUSETTS AIR SURVEILLANCE NETWORKNITROGEN DIOXIDE (NO₂) method: SODIUM ARSINITE units: PARTS PER BILLION (ppb)

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH. MEAN	GEOM STANDARD DEV.	MAXIMUM 24 hr OBS	2nd MAXIMUM 24 hr OBS
SITE LOCATION							

BERKSHIRE AIR QUALITY CONTROL REGION (117)

PITTSFIELD	1800-004	BK-03	61	19	1.43	42	33
DALTON AVE., STATE POLICE							

CENTRAL MASSACHUSETTS AIR QUALITY CONTROL REGION (118)

FITCHBURG	0620-003	CM-13	46	ID	1.44	38	37
G & E SUBSTA., SUMMER ST.							
WORCESTER	2640-012	CM-11	47	ID	1.34	60	58
WASHINGTON & NEW SALEM STS.							

MERRIMACK VALLEY AIR QUALITY CONTROL REGION (121)

LOWELL	1080-004	MV-09	58	32	1.41	62	58
JOHN STREET MUNIC. GARAGE							

METROPOLITAN BOSTON AIR QUALITY CONTROL REGION (119)

BOSTON	0240-002	MB-01	47	42	1.28	62	61
KENMORE SQUARE							
BOSTON	0240-016	MB-25	15	ID	1.55	71	48
CALLAHAN TUNNEL							
CAMBRIDGE	0360-004	MB-05	53	33	1.34	61	53
SCIENCE PARK							
MEDFIELD	1210-001	MB-28	8	ID	1.33	29	24
STATE HOSPITAL							
MEDFORD	1220-003	MB-19	48	33	2.43	77	50
WELLINGTON CIRCLE							
QUINCY	1880-002	MB-21	49	26	1.85	69	46
FORE RIVER BRIDGE							
WALTHAM	2340-004	MB-20	48	30	1.78	44	44
MAIN & MOODY STREETS							

(continued)

ID - UNEVEN DISTRIBUTION OF SAMPLES WITHIN THE YEAR PREVENTS ACCURATE
CALCULATION OF ANNUAL ARITHMETIC MEAN

1977 NO₂ BUBBLER SUMMARY

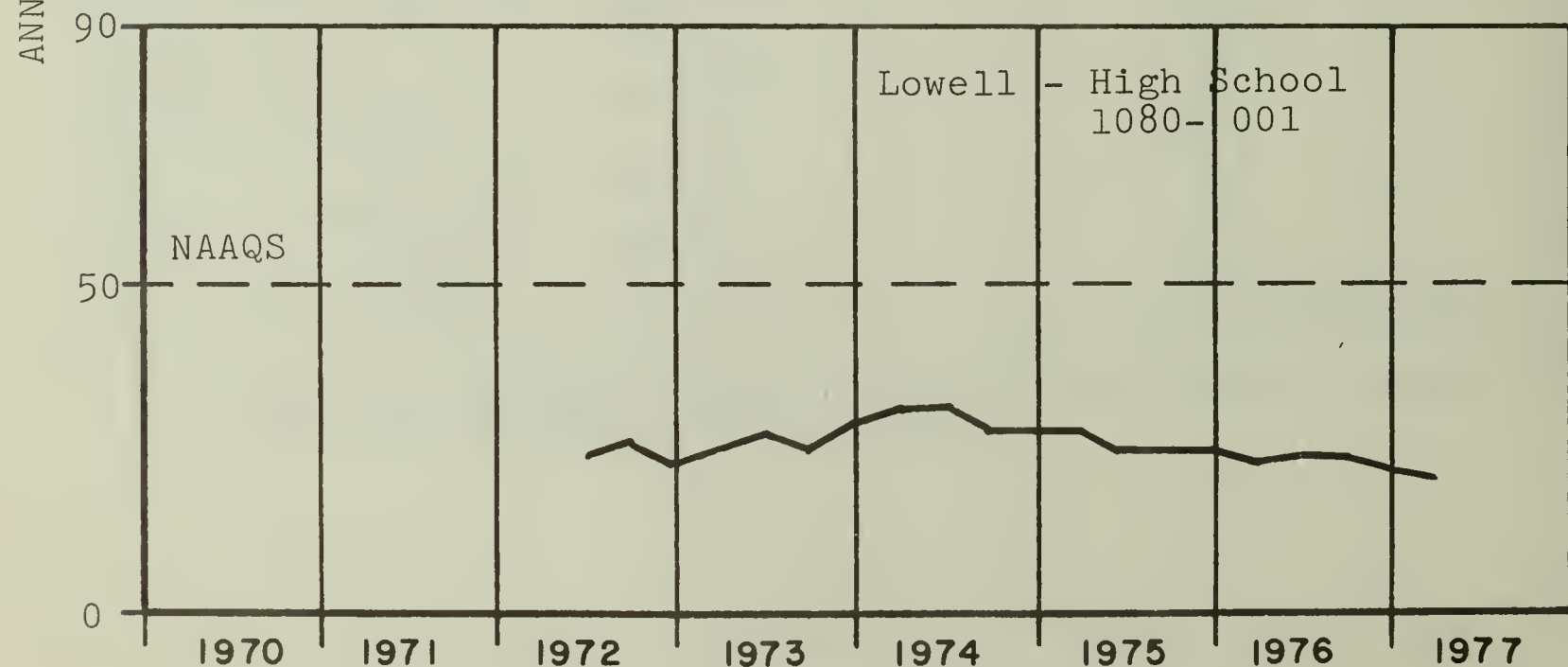
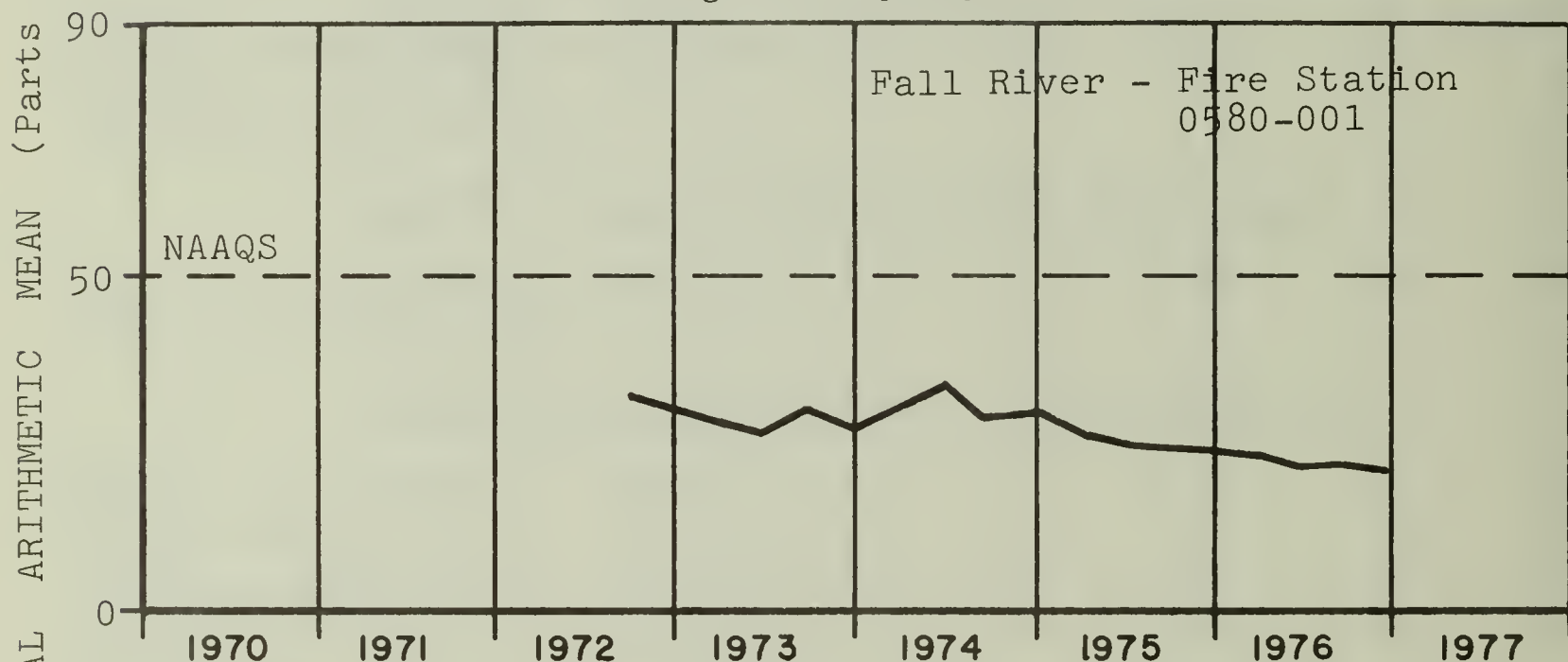
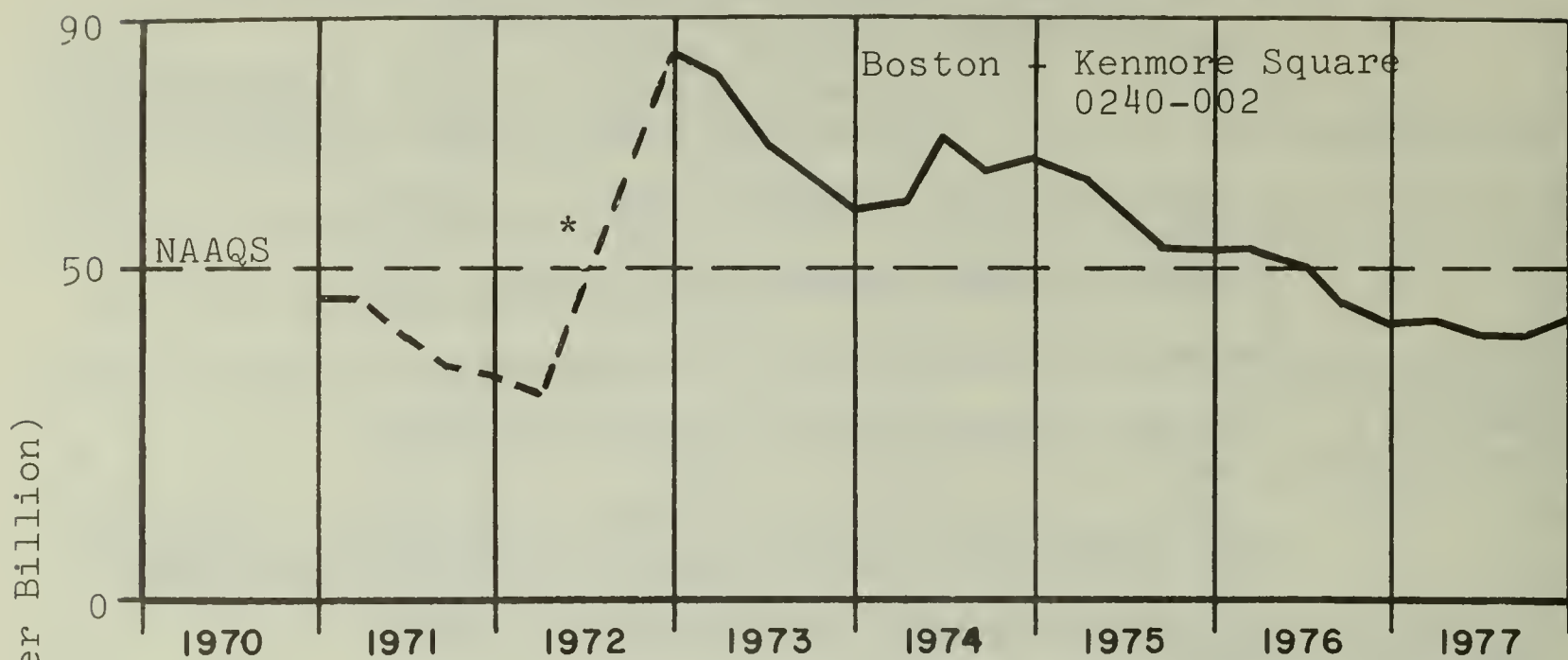
units: (ppb)

CITY	SAROAD I.D.	DIST I.D.	NUMBER OF OBS.	ANNUAL ARITH. MEAN	GEOM STANDARD DEV.	MAXIMUM 24 hr OBS	2nd MAXIMUM 24 hr OBS
SITE LOCATION							
<u>PIONEER VALLEY AIR QUALITY CONTROL REGION (042)</u>							
CHICOPEE	0400-005	PV-14	56	36	1.41	46	45
CHICOPEE STREET							
SPRINGFIELD	2160-005	PV-06	57	49	1.56	81	80
EAST COLUMBUS AVENUE							
<u>SOUTHEASTERN MASSACHUSETTS AIR QUALITY CONTROL REGION (120)</u>							
FALL RIVER	0580-004	SE-06	54	16	1.58	29	25
GLOBE STREET TRAILER							

FIGURE 14A

NITROGEN DIOXIDE (NO₂)
ANNUAL ARITHMETIC MEANS - RUNNING AVERAGES

Massachusetts Air Surveillance Network (MASN)



NAAQS - National Ambient Air Quality Standard

FIGURE 14B

ANNUAL ARITHMETIC MEANS - RUNNING AVERAGES
NITROGEN DIOXIDE (NO₂)

Massachusetts Air Surveillance Network (MASN)

